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AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.
Published Weekly

Volume 78

Number 23

P. M. HELDIT, Engineering Editor	HERBERT HOSKING, Editor	J. B. POLLOCK, Ass't Editor
JOS. GESCHELIN, Detroit Technical Editor	GEOFFREY GRIER, Art Editor	MARCUS AINSWORTH, Statistician
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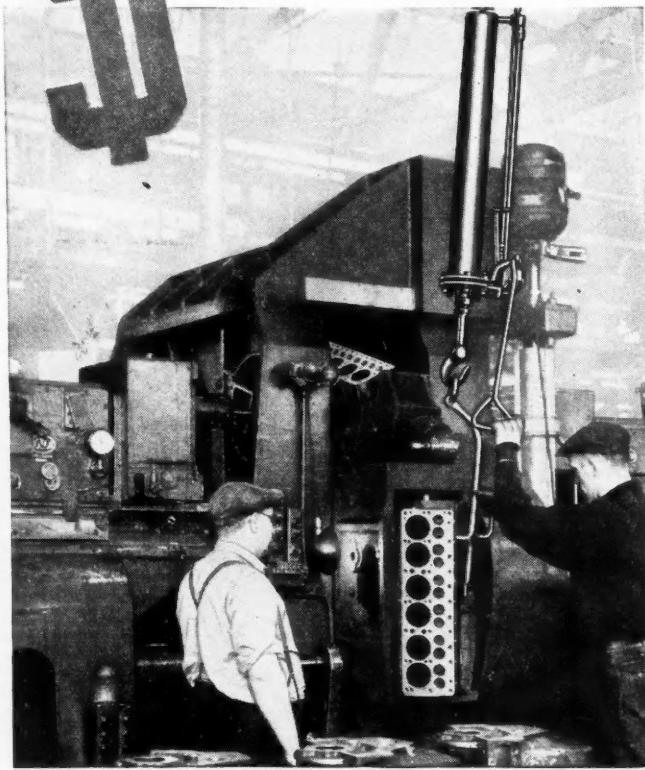
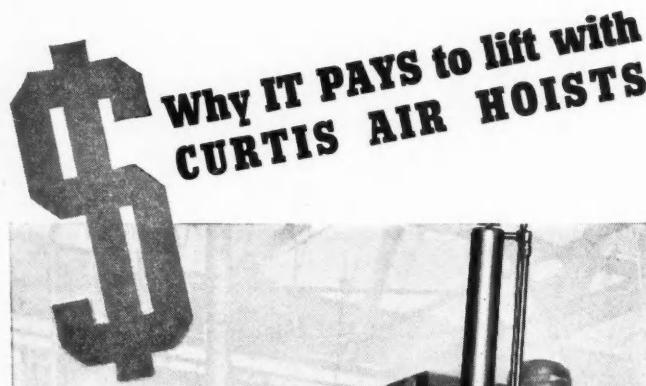
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Automotive Industries

AUTOMOTIVE INDUSTRIES



W. R. SPILLER

... has become affiliated with the Timken-Detroit Axle Co. in the capacity of sales engineer. Prior to accepting this appointment, Mr. Spiller was chief engineer of the White Motor Co., Cleveland.

Production

Downward Revision in Schedules Depresses Week's Output

Industry production figures for the current week will show a rather severe drop from those established during the final week in May, largely because Ford assembly plants were not in operation, although the total was affected also by further modifications in the schedules of other producers as they enter the final stages of this year's curtailed output.

With the beginning of the summer season and because of prevailing general business conditions, lower production levels may be expected to continue, although the best information available from reliable sources indicates that factories will continue to turn out cars and trucks as long as orders accumulate in sufficient quantities to warrant activity. Ford has announced that its plants will reopen on June 6, and the company

(Turn to page 741, please)

Goodrich and Goodyear Resume

Agreements Achieved After Feverish Weekend Efforts Of Government, Company and Union Officials

With peace reigning at least temporarily on the Akron labor front, after the bloodiest chapter yet written in the tire city's turbulent two-and-a-half years struggle with the CIO, thousands of tire builders streamed through the portals of the giant Goodyear and Goodrich factories, May 31, as both companies resumed operations after strike shutdowns. The Goodrich Akron factories had been closed and picketed since May 19 with 9300 employes idle and officials and office employes barred from the company's offices. The Goodyear factories and offices had been closed since May 26 when a clash between Akron police and Goodyear unionists of the CIO resulted in a riot in which five men were shot, 100 were injured by missiles and hundreds of others were gassed. The trouble was quelled when city officials mobilized all available Akron police officers in the riot zone and when Governor Martin L. Davey summoned 3600 Ohio National Guardsmen to stand ready for quick entry into the riot torn sector.

With the United States Department of Labor rushing its conciliator, P. W. Chappell, to the scene, with the URW sending a hurried SOS call to New York for Allen S. Haywood, prominent CIO organizer and leader, with Goodyear officials serving notice that the Goodyear plants would open at 6 o'clock Tuesday morning for all employes who wanted to work, and with Mayor L. D. Schroy asserting that law would be rigidly enforced, the American Federation of Labor joined hands with the CIO in the hurried formation of the Akron United Labor Defense Council composed of the heads of 75 A F of L and CIO unions. Preparations were made for a general strike completely paralyzing the city, with a threat of mass picketing at Goodyear by 50,000 unionists unless an armistice was signed. Company and union negotiators worked

feverishly over the Memorial Day weekend and on Monday night announced that an agreement had been reached. Several thousand Goodyear unionists, amassed at the Akron Armory, greeted the word with cheers and voted almost unanimously to cancel their strike and return to work pending further negotiations.

Goodrich unionists went back to work with a United Rubber Workers contract with the B. F. Goodrich

(Turn to page 740, please)

Labor

Tension in Detroit Seems Eased After Brass Plant Flare-Up

Intervention of a long holiday week-end contributed to the apparent easing of tension in Detroit's tumultuous labor situation after a pitched battle between police and pickets at a brass plant on May 26 had precipitated one of the most serious crises of the current industrial season. The battle had resulted in injuries to more than 60 persons, several of them seriously hurt, including police and strikers or sympathizers.

Perhaps the most important step in preventing continued hostilities was the issuance of a restraining order by Judge Lester S. Moll of the Wayne County Circuit Court, restricting the use of pickets to four at each entrance to the plant used by production employes. A large delegation of police was on hand when the plant reopened for production on May 31, but no pickets appeared and workers entering the plant were not molested.

Scene of the disturbance was the American Brass Co., which has been having labor difficulties since April 19, although company officials insist that no strike was in progress when the battle took place. Members of the International Union of Mine, Mill & Smelter Workers, a CIO

(Turn to page 741, please)

April Aircraft Exports Eclipse 1937 Dollar Volume For Same Month By 168 Per Cent

In terms of dollars, 1938 out-of-the-country shipments of "airplanes, seaplanes, and other aircraft" continue to be characterized by huge increases when compared with 1937. April exports in this classification, valued at \$4,220,514, overshadowed April, 1937, by approximately 168 per cent. For the first four months of this year, the dollar volume of these exports brightened by about 98 per cent, as compared with the figure for a similar period last year, to total \$11,261,552.

Exports of "automobiles, parts and accessories" for the four months ended April, 1938, totaled \$117,824,103, an increase of slightly more than 4 per cent over the figure for this period last year. Generally, April exports in all classifications listed herewith are slightly below those for March of this year.

	APRIL 1938		APRIL 1937		FOUR MONTHS ENDED APRIL			
					1938		1937	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles, parts and accessories		\$ 26,369,817		\$ 30,791,261		\$ 117,824,103		\$ 113,171,080
PASSENGER CARS								
Passenger cars and chassis	15,564	9,781,032	22,654	13,105,249	70,971	44,484,088	81,900	48,243,347
Low price range \$850 inclusive	13,533	7,578,535	20,565	10,724,144	61,766	34,466,181	74,577	40,084,453
Medium price range over \$850 to \$1,200	1,743	1,710,124	1,635	1,556,737	7,886	7,797,858	5,928	5,630,908
\$1,200 to \$2,000	233	344,763	323	501,523	1,045	1,543,337	1,009	1,562,600
Over \$2,000	55	147,610	131	322,845	274	676,712	386	965,386
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	9,903	7,076,773	12,233	7,462,800	53,448	33,322,428	46,364	25,353,517
Under one ton	1,614	739,527	1,577	589,350	7,398	3,099,681	5,808	2,174,486
One and up to 1½ tons	5,881	3,215,999	7,717	3,732,240	37,217	20,044,242	32,494	15,023,388
Over 1½ tons to 2½ tons	1,178	988,941	1,970	1,732,556	5,519	4,455,164	5,716	4,622,630
Over 2½ tons	1,008	1,932,801	945	1,385,517	2,536	5,154,724	1,986	3,255,958
Bus chassis	224	198,505	24	23,137	778	568,609	360	277,055
PARTS, ETC.								
Parts except engines and tires		4,789,670		4,322,494		21,086,262		20,555,329
Automobile unit assemblies		3,273,258		4,128,835		12,706,913		12,020,500
Automobile parts for replacement (n.e.s.)		282,978		334,650		1,142,429		1,427,277
Other automobile accessories (n.e.s.)		196,178		506,221		612,935		2,098,807
Airplanes, seaplanes and other aircraft	72	4,220,514	53	1,572,302	231	11,261,552	176	5,696,951
Parts of airplanes, except engines and tires		2,215,862		857,189		7,688,624		2,552,631
INTERNAL COMBUSTION ENGINES								
Stationary and Portable								
Diesel and semi-Diesel	69	201,236	81	154,974	191	877,276	261	572,676
Other stationary and portable								
Not over 10 hp.	904	57,380	3,524	154,528	3,892	269,314	8,024	415,891
Over 10 hp.	436	214,360	445	220,400	1,193	489,963	986	524,026
Engines for:								
Motor trucks and buses	2,945	273,779	3,449	334,279	12,611	1,380,098	12,144	1,214,865
Passenger cars	4,659	372,659	7,998	521,769	23,256	1,876,287	33,740	2,265,787
Aircraft	124	573,367	106	563,004	428	2,307,859	356	2,023,332
Accessories and parts (carburetors)		278,632		248,150		1,007,846		887,799
IMPORTS								
Automobiles (dutiable)	45	28,587	77	52,676	232	137,961	433	284,464

To Produce Synthetic Gasoline In Transvaal, Africa

The Government of the Union of South Africa is considering the construction of a plant for the production of synthetic gasoline. The plant is to be located in the coal-mining district of the Transvaal, and it is figured that an investment of three million pounds sterling will be necessary.

In order that the enterprise may prove profitable, it is planned to locate the factory far from the coast, where the cost of transportation adds considerably to the cost of imported gasoline. At the present time, the

Transvaal imports approximately 400,000 tons of petroleum products per year. Professor Franz Fischer, whose hydrogenerating process is to be employed, has left for Capetown to consult with the government officials in charge of the project.

Car Sales in Eastern Canada Register Strong Improvement

Car sales in eastern Canada for April registered strong improvement. The total of leading models is estimated within a few hundred of the heavy sale of a year ago.

Contrary to the sharp decline in

March, April totals for some models were actually above sales of a year ago and the big three—Chevrolet, Ford and Plymouth—only slightly behind. For the first four months, total sales of leading models in eastern Canada amounted to 25,723 units, or about 16.7 per cent below the corresponding period in 1937. Details are as follows:

New Passenger Car Registration (In Eastern Canada)				
April 1938	April 1937	1938	1937	Year to Date 1938
Ford	2,503	2,880	6,582	7,364
Chevrolet	2,404	2,791	5,094	6,669
Plymouth	1,651	1,516	3,681	4,242
Dodge	1,637	1,805	3,767	5,077
Pontiac	753	881	1,707	2,120
McL.-Buick	582	545	1,375	1,334
Oldsmobile	476	808	1,064	1,960
Chrysler	466	370	1,090	1,237
Lafayette	381	329	809	693
Hudson	258	77	554	190
		11,111	12,002	25,723
				30,886

SAE World Congress History-Making Technical Program Planned for May 22-June 8, 1939

A World Automotive Engineering Congress has been scheduled for May 22 to June 8, 1939, by the Society of Automotive Engineers. According to John A. C. Warner, secretary and general manager of the Society, tentative plans include five days of technical sessions and a banquet soon after the New York World's Fair opens, and arrangements will be made for members of the Society and their guests to attend the big New York event. Grover Whalen, president of the World's Fair, has been asked to greet the leading automotive engineers of the world, and to officially open the Congress.

Committee work to plan for the best technical program in the 33-year history of the Society has already begun. The sessions will report engineering advances throughout the world in design, manufacture, and operation of automobiles, aircraft, trucks, buses, and rail-cars, and fuel and lubrication refining.

Following the New York sessions, delegates will attend the twenty-seventh Annual 500-Mile International Sweepstakes at the Indianapolis Speedway, May 30, spend the three following days inspecting principal automotive plants in Detroit, and close the Congress with three days of technical sessions in San Francisco, where they will have an opportunity to visit the Golden Gate Exposition.

Plans for the Congress are being made under the general direction of C. W. Spicer, president of the Society, and the executive committee on meetings, which is com-

posed of Ralph R. Teetor, past-president, chairman; Dr. G. W. Lewis, National Advisory Committee for Aeronautics, vice-chairman; Paul G. Hoffman, president, Studebaker Corp.; O. E. Hunt, vice-president, General Motors Corp.; and Fred M. Zeder, vice-chairman of the board, Chrysler Corp.

**Order For 75 Coaches
Received by acf**

The Brooklyn Bus Corp., New York, has placed an order with the a.c.f. Motors Co. for 75 of its 35-passenger coaches powered with the Hall-Scott horizontal type engine.

Chevrolet Offers COE

Cab-Over-Engine Truck Available On Three Wheelbases

Chevrolet has announced its entry into the cab-over-engine truck field with the Chevrolet-Montpelier COE available in the three wheelbases of the 1½-ton chassis; 108-in., 131½-in., and 137-in. With one of these units, bodies ordinarily used on a 157-in. wheelbase chassis can be used on a 131-in. wheelbase chassis. See illustration on this page.

The overall length of the 108-in. wheelbase chassis is 172½ in. and the distance from the back of the cab to the center line of the rear axle is 61 in.; weight of the complete chassis, 3745 lb.

In the intermediate wheelbase, the length overall is 196½ in., the distance from back of cab to center line of rear axle is 84½ in., and the weight 3825 lb. Corresponding figures for the 157-in. chassis are 221½ in. overall length, 110 in. from back

of cab to center line of rear axle, and weight, 3905 lb.

Overall width of all three models is 71¾ in., and distance from front bumper to front axle center line is 29¾ in. From center line of front axle to rear of cab is 47 in. in all models, and from the same point to the back of the steering wheel is 25½ in. It is 10½ in. from the center line of the steering wheel to the chassis center line, and 37½ in. from the center line of the rear axle to the end of the frame.

Front axle capacity rating on all models is 4000 lb. Front wheel tread

compartment and then drop the batch directly on the rolls of the mills below. After being worked thoroughly, the rubber is removed and cooled before going to the next mill for further working. (See story this page.)

FORD'S TIRE PLANT—

at Dearborn, Mich., built at a cost of \$5,600,000, houses these big mixers (back row) which mix crude rubber and other ingredients in an enclosed

is 57½ in. Rear wheel tread, with single wheels is 57 25/32 in. and with dual wheels, 66 1/32 in. Cab width is 58 in., and cab height above chassis frame 64 in. A 16-to-1 steering ratio is standard, with 17-in. heavy-duty steering wheel.

Ford's New Tire Plant

*Present Production of \$5,600,000
Factory Estimated at 4000 a Day*

A \$5,600,000 tire plant embodying scores of departures from conventional tire building methods has virtually been completed by the Ford Motor Co. at its Rouge plant, Dearborn, Mich. Production rate at the present time is reported at 4000 tires a day, although much of the equipment remains to be installed. It is said that capacity of this plant, ultimately, will be 6000 tires and tubes per eight hour shift.

The building itself has many unusual design features. The structure covers four and a half acres, has 435,000 sq. ft. of floor space and 70,000 sq. ft. of window glass. This glass is of a special type which filters out the actinic rays of the sun to prevent oxidation of the rubber. Filtered air is provided throughout.

The Ford tire at present is being constructed only in the 6.00 by 16 size.

A complete description of the new plant will be published in an early issue of AUTOMOTIVE INDUSTRIES.



CHEVROLET'S COE —

A three-quarter front view of the new Chevrolet-Montpelier cab-over-engine

truck which was just announced. Three wheelbases are offered on a 1½-ton chassis; 108-in., 131½-in., and 137-in.

Goodrich and Goodyear Resume

(Continued from page 737)

management—the second such contract with a major tire company. The first CIO contract with a major tire company was signed with Firestone a year ago and has just been renewed. Goodyear workers went back to work under terms of a truce voted by the URW pending adjustment of union grievances and negotiations in the direction of a written contract.

The Goodyear crisis came simultaneously with settlement of the Goodrich strike, and resulted when, in the face of a strike threat, the company ordered trucks loaded with tires to leave the plant. Union pickets attempted to block the egress of the trucks. Riot calls brought the police to the scene with gas grenades and riot guns. Utilizing the radio, the URW hurriedly broadcast appeals for picket re-inforcements. Police radio cruisers were overturned. Windows of passing automobiles were shattered by bricks. Dozens of store fronts and office windows were shattered by flying missiles and tear gas bombs. Five, including one police officer, were shot in the melee. Nearly 100 were taken to hospitals for emergency treatment. The battle raged for hours but the crowds were finally dispersed by the police who formed a solid phalanx in front of the Goodyear main factory gates.

As the Goodyear and union negotiators went to work, and as the unions laid plans for a general strike, union leaders exhorted their men to meet armed resistance at Goodyear.

"Not even guns or cannon will stop us the next time. If we had known what was going to happen you soldiers of industrial warfare would have held East Market Street and not the police," the daily press quoted Frank Grillo, URW international secretary, as telling a huge union mass meeting.

Mayor Schroy met Grillo's statements with the charge that the URW was inciting to riot and rebellion.

Under terms of the new Goodrich contract, union grievances are adjusted with paid vacations for 5 and 10 year veterans. The pay vacation scale, however, is cut to one-half of previous years. Each man with 10 or more years' service record will get two weeks' vacation with 2 per cent of his 1937 earnings. Each man with a record of between 5 and 10 years will get one week's vacation with 1 per cent of his 1937 earnings. The

previous rate of vacation pay had been 4 per cent and 2 per cent respectively. It is stated unofficially that this compromise saves the Goodrich company approximately \$230,000.

The new Goodrich contract makes no mention of possible wage cuts. Recently the company had said that unless employees accepted a wage cut averaging 12.3 per cent it would have to transfer 5000 jobs out of Akron. The pact was signed by T. G. Graham, vice-president, with the understanding that it was subject to approval of Goodrich directors. S. S. Robertson, president, in the name of the company and board signed the pact on Friday.

The Goodyear truce provides:

1—That 16 employes "promoted out of line" to go back to their regular jobs.

2—A promise to review all grievances concerning seniority and transfers, retroactive to Jan. 1 under terms of an agreement to be negotiated later by the company and the union.

In addition, a verbal "pledge" was made to the committee to discuss all wage cut plans with the union before putting them into effect, and to start negotiations for a written contract, URW officials told membership at the special meeting.

The company expects "to continue to negotiate in an orderly manner any legitimate grievances that may arise," a statement issued after the strike settlement said.

"The charges made by the union that the strike, called by its executives, was inspired by a company plot are too ridiculous to be considered by any sane person.

"The company wants, and for many weary months has been striving for, peace and orderly procedure. We expect to continue to negotiate in an orderly manner any legitimate grievances that may arise."

"Any talk in the conferences about a signed agreement was limited on our part to a mere expression of willingness to discuss the subject at a future time."

The union had submitted six grievances, principally concerning seniority, as the cause of the strike that started Thursday night and developed into a riot that caused the injury of more than 100 persons.

A resolution adopted by the membership last night states:

"Therefore because these concessions have been gained, and because the company has pledged itself to conclude a written agreement with the union, we hereby declare the present stoppage of work ended and advise all Goodyear local members to return to work on their regular shifts."

After the strike had been concluded, Mayor Schroy issued a statement which declared that "Fortunately for all concerned the members of the union realized Monday night that the duly constituted civil authority of Akron is supreme and that it had the power and ability to see that this authority was not seized by any group."



KENNETH W. HILDENBRAND recently joined the sales engineering division of Monroe Auto Equipment Co., Monroe, Mich. He is well known among factory engineers through his many years of work with John Warren Watson on shock absorbers, springs, and special devices for spring suspensions.

G. P. HOWELL has been appointed district manager of the strip steel division for Wisconsin and Upper Michigan for the Acme Steel Co. For the 17 years prior to his becoming associated with Acme Steel Co., Mr. Howell was director of purchases for the Seaman Body Corp. Previously, he was purchasing agent for Buick Motor Division of the General Motors Sales Corp. and Nash Motors Division of Nash-Kelvinator Corp.

C. D. MCKIM has been appointed secretary of the Wholesalers Division of the National Standard Parts Association.

CHESTER RICKER, who has served as an official at every 500-mi. race since 1911, celebrated his Silver Anniversary as director of timing and scoring of the Indianapolis 500-mi. race at this year's Memorial Day event. Mr. Ricker authored the article on the 1938 classic which appears in this issue.

KENNETH MATTHEWS, manager of Matthews Tire & Tread Co., Jamestown, N. Y., was elected to the directorate of the Advertising Affiliation at its thirty-fifth annual convention held recently at Hamilton, Ont., in Canada.

WALTER K. DOW was recently elected vice-president of The Alexander Milburn Co., Baltimore, Md. Before becoming associated with Milburn, Mr. Dow was identified with the DeVilbiss Co., Toledo, Ohio. He has been plant superintendent of the Milburn Co. for the past year.

J. M. CHAPPLE, has been named managing director of the Lincoln Electric Co.'s new manufacturing subsidiary, Lincoln Electric Co. (Australia) Pty., Ltd., recently established at Alexandria (Sidney), Australia. Mr. Chapple will be in charge of manufacturing, sales and advertising of the new company.

ROBERT H. HEYER, metallurgist in the research laboratories of the American Rolling Mill Co., has been notified that he will receive the Charles B. Dudley Medal

of the American Society for Testing Materials because his paper, "Analysis of the Brinell Hardness Test," offered at the society's 1937 meeting was "an outstanding contribution in the field of research." The medal will be presented to Mr. Heyer at the 1938 meeting of the society, June 27 to July 1, at Atlantic City, N. J.

ALEXIS LAPTEFF has joined the staff of Count Alexis de Sakhnoffsky, engineering stylist. Mr. Lapteff has been associated with the design department of General Motors and Briggs Body Co. as well as the architectural firm of Albert Kahn, Inc.

Labor

(Continued from page 737)

union, have been picketing the plant in protest against an alleged wage cut and employment of strike breakers, although, in obtaining the court order, the company also charged that a majority of the pickets never had been employees of the company.

On May 26 a large delegation of United Automobile Workers Union members joined their CIO affiliates on the picket lines at the time when employees would leave the plant. Hostilities started when more than 100 police were sent to protect the employees as they were leaving the plant and, according to the police, when a shower of stones and bricks greeted the first auto load of workers to leave the plant. As evidence of the alleged intent of the pickets, police confiscated a large number of two-by-two sticks to which small placards had been attached, but which, police said, were readily converted into dangerous clubs, and so used.

CIO and UAW leaders announced after the riot that a 24-hour general strike might be called unless assurances would be given by city officials against the use of police as strike breakers. Meetings to determine a course of action were scheduled to be held this week after a union delegation had presented its demands to the Detroit city council on May 31.

Some observers of union activity have seen in the demotion of Richard Frankenstein by Homer Martin, UAW president, a move to enhance the position of Walter P. Reuther, leader of the left wing "unity" faction in the UAW and nominally opposed to some of the more conservative policies of the "progressive" faction, of which Martin is the leader. In announcing the removal of Frankenstein from director of the Ford organizing drive, recently, Martin stated that the campaign probably would be directed by a five-man committee, of which Reuther would be a member. Reuther is also head of the large West Side local in Detroit. He is said to be advocating a more militant drive in the Ford

AUTOMOTIVE ABSTRACTS



The New Model Bristol Perseus Aircraft Engine

A new model of the Bristol Perseus single-sleeve-valve aircraft engine, the Perseus XII, passed the 100-hour test of the British Air Ministry. It is a moderately supercharged nine-cylinder radial single-sleeve-valve unit of 52-in. over-all diameter, which develops a maximum of 905 hp. at 6500 ft., the international rating at this altitude being 715-745 hp., and the power at take-off, 795-830 hp.

One of the novel features of the Perseus XII is a gearbox which enables the large number of engine-driven accessories required for mod-

ern aircraft to be mounted on the bulkhead instead of on the engine itself. The gearbox is driven from the rear of the engine by an enclosed jointed shaft. The spark-timing control of the magneto is now inter-connected with the throttle in such a way that the best timing is obtained automatically for each throttle setting. Two spring-loaded shutters, operated by a single control lever, regulate the proportion of hot to cold air admitted to the engine. The Perseus XII engine is approved for use with a controllable-pitch propeller, and a 13-ft. de Havilland-Hamilton propeller was used in the tests.—*Engineering*, May 6.

workers' organizing campaign, and had participated in the campaign actively last fall until the appointment of Frankenstein as director.

Production

(Continued from page 737)

expects to get in 19 productive days during the month, which means a resumption of the five-day schedule.

Other producers also, especially the major ones, report that modified schedules will be maintained through June and expectations are that they also will continue through most of July, with no general beginning of retooling and changeovers in prospect until August. That is the picture as it exists at present, thus making retail sales entirely the barometer insofar as the industry at large is concerned.

A check of factory production schedules for the current week provides an unofficial estimate of output totalling 30,600 units. General Motors was the major contributor to the week's total with 16,400 cars and trucks, of which Chevrolet was responsible for approximately 10,000, Pontiac 1200, Oldsmobile 1300, Buick 3500, and Cadillac-LaSalle 400. Chrysler divisions contributed the next largest share with an estimated output of 8700, while most of the independents continued on about the same basis as that of the previous week, although Studebaker showed a drop from 1076 a week ago to 84 this week.—J. A. L.

April Exports of Truck and Bus Tires Gain 50% Over 1937

The Commerce Department reported this week that \$477,553 worth of truck and bus tires were exported in April, an increase of about 50 per cent over April, 1937, exports. April exports this year, however, represented an increase of 23.7 per cent over the previous month's exports.

Other automobile casings exported in April amounted to \$585,570, a decline of about 20 per cent in tire exports over April, 1937, but an increase of 20 per cent over the March, 1938, figures, the Department said. (See item on page 747.)

Bendix Announces Changes In Executive Staff

Bendix Products Corp. this week announced four changes in its executive staff. Malcolm P. Ferguson, Elmira, N. Y., former executive of the Eclipse Machine Co., a Bendix subsidiary, has been named vice-president and general manager of Bendix Products Corp. Victor W. Kliesrath, vice-president and director, Bendix Aviation, and vice-president and general manager of Bendix Products, has been appointed head of the new Marine Development Division with headquarters in New York. John P. Mahoney was made vice-president in charge of industrial relations for Bendix Products. Herbert L. Sharlock, vice-president and director of publicity, Bendix Products, was advanced to director of public relations of Bendix Aviation Corp.

Business in Brief

Written by the Guaranty Trust Co., New York

Business activity was maintained at a virtually unchanged level last week. The index of the *Journal of Commerce* advanced fractionally, standing at 70.5, as against 70.3 a week earlier and 105.8 a year ago. However, sentiment was unfavorably affected by continued weakness in commodity and security markets.

Adverse weather conditions and increasing unemployment continued to overshadow retail trade markets, with the result that the few Memorial Day gains were more than offset by general declines, according to Dun & Bradstreet. Wholesale buying was restricted; forward orders were absent or released with hesitation, and in most markets commitments covered only the barest immediate needs.

Railway freight traffic increased slightly during the week ended May 21. Loadings during that period totaled 545,808 cars, showing a gain of 3995 cars, or 0.7 per cent above the level for the preceding week but a decrease of 229,266 cars, or 29.6 per cent below that for the corresponding period last year.

Production of electricity by the electric light and power industry of the United States for the week ended May 21 was virtually equal to that in the preceding week but 10.5 per cent below that in the similar period a year ago, according to the weekly report of the Edison Electric Institute. This margin of decline is about the same as reported in the two weeks preceding, when output was 10.3 per cent and 10.9 per cent,

respectively, below last year's comparable figures.

The lumber industry during the week ended May 14 stood at 55.5 per cent of the 1929 weekly average of production and 54 per cent of average 1929 shipments. Reported production was slightly larger than in the preceding week, while new orders and shipments were smaller. New business was 4 per cent below output and shipments 6 per cent below.

Crude oil production declined sharply during the week ended May 21, averaging 3,175,750 barrels daily, showing a drop of 186,550 barrels below the output a week earlier, and comparing with an average of 3,550,450 barrels a year ago. The decline reflects the Saturday and Sunday shut-downs ordered in Texas, together with further restrictions imposed by other States.

Professor Fisher's index of wholesale commodity prices for last week stands at 80.8, as against 81.4 a week ago, 80.8 two weeks ago, 80.5 three weeks ago, and 80.6 four weeks ago.

Member bank reserve balances increased \$94,000,000 during the week ended May 25, mainly as a result of a decline of \$100,000,000 in Treasury deposits with the Federal Reserve banks, together with an increase of \$13,000,000 in the monetary gold stock and a decline of \$9,000,000 in the amount of money in circulation. Excess reserves of member banks on that date were estimated at \$2,630,000,000, showing an increase of \$70,000,000 for the week.

No. 1 which describes its line of hardness testing machines.*

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Ford Financial Report

*Surplus of \$608,085,935
at Dec. 31, 1937*

The Ford Motor Co. reported a surplus of \$608,085,935 in its statement of condition as of Dec. 31, 1937, filed last week with the Massachusetts Commissioner of Corporations and Taxation. As compared with the \$602,666,672 surplus of the preceding year, this is an increase of \$5,419,263. The company's balance sheet showed a decrease in reserves during the year from \$17,699,023 to \$9,184,689.

The complete statement, with comparable 1936 figures noted in parenthesis, is as follows: Assets—cash, notes and accounts receivable, stocks, bonds, securities and patent rights, \$317,387,395 (\$378,119,715); real estate, \$122,375,918 (\$123,275,143); machinery, equipment, etc., \$125,645,402 (\$118,519,373); merchandise and supplies, \$135,943,385 (\$95,002,833); prepaid insurance, taxes, etc., \$3,570,439 (\$2,442,300). Total, \$704,922,541 (\$717,359,366).

Liabilities — accounts payable, \$70,387,416 (\$79,729,170); reserves, \$9,184,688 (\$17,699,022); capital stock, \$17,264,500 (\$17,264,500); surplus, \$608,085,935 (\$602,666,672). Total, \$704,922,541 (\$717,359,366).

Advertising Affiliation Convention Addressed by W. J. Cameron

An address entitled "Looking at Our Job" by W. J. Cameron, director of public relations for the Ford Motor Co., was one of the high spots of the thirty-fifth annual convention of the Advertising Affiliation held recently in Hamilton, Ont. The convention was attended by nearly 500 delegates representing the 12 affiliated clubs in Canada and the United States.

Mr. Cameron dealt with Henry Ford's three rules for advertising: 1. No comparative statements; 2. No competitive statements, and 3. Be informative. "We have reduced salesmanship to a kind of psychological assault," he said, "forgetting that the consumer will go back again and again to the man who helps him to buy. There should be bigger profit to the buyer in a sale than there is to the seller, and good advertising is that which helps people



The L. S. Starrett Co., Athol, Mass., has brought out the twenty-sixth edition of its catalog which contains complete descriptions and prices of the more than 3000 tools and standard items in the Starrett line.*

"Pay Loads for '38 with Rex Moto-Mixers and Agitators" is the title of a new publication published by the Chain Belt Co., Milwaukee, Wis.*

The Inland Steel Co. has issued bulletin No. 50 which describes the development, physical properties and applications of its

recently announced lead-bearing, open-hearth, free-cutting steel trade-named *Ledloy*.*

Complete up-to-date information on its line of **power operated circle shears**, ring and circle shears and flangers has been published by the Niagara Machine & Tool Works, Buffalo, N. Y., in bulletin No. 70-D.*

The Pyle-National Co., Chicago, has brought out bulletin No. 1125 which describes its line of "Vaportight" industrial lighting fixtures.*

Bliss & Laughlin, Inc., Harvey, Ill., has issued a bulletin on **alloy steels**.*

A. Schrader's Son, division of Scovill Mfg. Co., Inc., has prepared a booklet "Tractor Traction," which explains the advantages and uses of the company's **spark plug air pump, tractor tire gage, and standard valve caps and cores**.*

Tinius Olsen Testing Machine Co., Philadelphia, Pa., has published a new bulletin

to buy intelligently with full protection to themselves. The advertisement that pleases the advertiser is often the worst possible advertisement, and what is needed is plain educational advertising."

Ford's public relations director denounced the loose use of the word "propaganda." "All teaching is 'propaganda,'" he maintained, "The 10 Commandments are propaganda. Advocating the use of toothbrushes is propaganda. Why should the word be regarded as something that describes the spread of pestilence and evil? It is equally descriptive of efforts to sweeten the atmosphere and spread light. It is neither honest nor rational to denounce industry's reply to criticism as offensive 'propaganda'".

Congressmen Endorse Highway Plan Proposed by Drew

Congressional members and highway engineers from four states last week endorsed the Drew bill to construct a super-highway from Washington to Jersey City and promised to assist in the development and coordination of the plans.

Representative Drew, Democrat of Pennsylvania, described his proposal as contemplating the construction by each state of intra-state projects to be tied into the New Jersey-Washington highway. Financing through state bond issues and Federal work-relief is proposed by the congressman.

He referred to the Pennsylvania law under which a \$65,000,000 ex-

(Turn to page 745, please)



Ame Photo

Automotive Industries

From Milwaukee to South Bend

Finance-Company Case Reopened With "Big Three" Indicted on Charges of Sherman Anti-Trust Act Violations

Three of the largest concerns in motordom were indicted by a Federal grand jury late Friday, May 27, in a report handed Judge Thomas W. Slick of the northern Indiana district in South Bend. The jury, after a five-day session, found the evidence sufficient to warrant prosecution of the Ford Motor Company, Chrysler Corp., and General Motors Corp., on charges of conspiracy to violate the Sherman Anti-Trust Act. Listed in the Government's indictments are such names as Alfred P. Sloan, Jr., William S. Knudsen, Walter P. Chrysler, and Edsel B. Ford.

"The indictments," United States Attorney James R. Fleming said, "are charging conspiracy to violate the Sherman Anti-Trust Act by stifling and interfering with interstate commerce for the promotion of monopoly. This was done by the coercing of dealers to finance their automobiles through manufacturer-controlled finance companies—Ford through the Universal Credit Corp.; General Motors through the General Motors Acceptance Corp.; and Chrysler through the Commercial Credit Corp. These practices brought about irreparable damage to the small business men throughout the country."

Mr. Fleming has announced that the trials will be separate. Which one is to be tried first he was unable to say; this is to be decided late this summer by Attorney General Homer S. Cummings. The trials are ex-

Background

The reader who wishes to refresh his memory with what has gone before in Federal investigation of finance company relations with the automobile manufacturers is referred to the article "How A Federal Judge's Action Threw Finance-Company Case Into a Styx," which appeared in AUTOMOTIVE INDUSTRIES, Jan. 15, page 74.

pected to start in October. The Government has indicated it would be lenient in permitting defendants a period of two or three weeks to appear for arraignment and to arrange bond. Failure to appear within that period will mean that warrants will be issued for arrest of those not complying with the order. Counsel for many of the defendants have indicated that their clients would appear in person as required. Those who do not appear in South Bend for arraignment will be arraigned in their own Federal districts.

Mr. Fleming will have charge of the Government's trial in October and assisting him will be Russell Hardy, Edmund Ford and J. Stephen Doyle, legal aids of Attorney General Cummings, who are now in Washington after spending several weeks in South Bend preparing the Government's case, and Alex M. Campbell, South Bend, and Luther M. Swygart, Hammond, Ind., assistant attorney in Mr. Fleming's office.

"We do not intend to show the defendants any favors because they are large industrialists," said Mr. Fleming, "and by the same token we do intend to persecute them. This case will be handled the same as any other."

Those listed on the indictments are the following:

The United States against the Chrysler Corp., Chrysler Sales Corp., Dodge Brothers Corp., DeSoto Motor Corp., Plymouth Motor Corp., Commercial Credit Co. and all its branches, Walter P. Chrysler, H. A. Davies, Alexander E. Duncan, James C. Fenhaman, Byron C. Foy, W. Cameron Forbes, R. Walter, William H. Grimes, B. E. Hutchinson, D. J. Hutchinson, S. H. Lauchheimer, H. B. Mathews, T. Stockton Mathews, C. Y. Palitz, George Ramsey, F. J. Timmons, A. Van Der Zee, Howard L. Wynegar.

The United States against the Ford Motor Co., Universal Credit Corp., Universal Credit Co., Inc., Edsel B. Ford, C. J. Bamford, H. C. Eutkiewicz, W. C. Cowling, Arthur O. Dietz, Ernest Kanzler, H. A. Mack, Harry A. Mack, C. R. Mullan, Elmer A. Rolley, Charles C. Sorensen, H. H. Walter and W. L. Yule.

The United States against the General (Turn to page 746, please)

June 4, 1938

Nash Sales Campaign to "Go National" on June 14

Nash-Kelvinator Corp., including both its automotive and refrigerator divisions, took the national spotlight this week with announcement of its plans to launch a nation-wide business building campaign which has as its basis the glorification of the salesman and which proposes to attack the doldrums into which all divisions of industry have fallen by inspiring sales organizations to make aggressive drives for business.

Scheduled to get under way on June 14, the crusade has taken for its slogan the words "Sales Mean Jobs." Plans have been perfected to launch the crusade at rallies which have been scheduled in 89 cities during the week. While initiated by George W. Mason, president of Nash-Kelvinator, selling organizations of all industries are being invited to take part, and the support of Chambers of Commerce, other civic organizations and newspapers has been assured. The crusade will receive its official national send-off at a huge public rally to be held in New York on June 14 with business leaders in all fields in attendance.

Interest in the crusade has been snowballing since results of a six-day trial campaign in Lincoln, Neb., were announced. In Lincoln, car dealers representing practically all makes as well as sales organizations in other industries, supported by civic organizations and newspapers, conducted a widespread door-bell ringing campaign which resulted in tangible sales increases as well as the uncovering of valuable lists of prospects.

Analysis Shows Large Increase In Long Term Instalment Sales

A disappointing increase in long term instalment sales of new and used cars, continuing a trend in effect since 1933, is reported in an analysis of 1937 financing by the National Association of Sales Finance Companies.

The report indicates that the percentage of paper over 12 months' maturity increased to 68 per cent during 1937 from 58.9 per cent in 1936.

New car paper of over 18 months' maturity increased from 26.9 per cent in 1936 to 44.2 per cent in 1937. For new and used car paper combined the increase was from 18.4 per cent to 28.7 per cent. There is believed to have been a considerable reduction in long term paper during the

latter part of 1937 but not sufficient to overcome the tendency toward increasing terms in effect during earlier months.

Percentage of paper showing sub-standard down payments, however, showed a decrease from 1936 which in turn showed a decrease from 1935 although the 1937 figure is still greater than in any year prior to 1935.

The percentage of new cars sold on instalments decreased from 60.7 in 1936 to 57.2 in 1937. Used car figures, however, showed an increase from 58.5 per cent in 1936 to 60.1 per cent in 1937 with new and used car financing combined showing a slight drop from 59.4 to 59 per cent.

Repossessions increased sharply going to 9.4 per cent for new and used cars combined as compared with 5.1 per cent; the largest for any year except 1932, when repossession averaged 10.4 per cent. The number of skips per thousand deals was the lowest on record being 1.7 for 1937 as compared with 2.6 for 1926 and 5.5 for 1932 and 1931.

Resistoflex Corp. to Make Tubing For Oils and Solvents

Resistoflex Corp. has announced the completion of facilities at its plant in Dover, N. J., for the manufacture of "Resistoflex" PVA tubing in diameters up to and including $\frac{1}{2}$ -in. I.D.

"Resistoflex" is the trade mark and trade name employed in the American production of a flexible synthetic resin—basically, polyvinyl alcohol—which is inert to gasoline, oils and organic solvents. It is said to retain its flexibility throughout a wide temperature range. The product has been manufactured, tested and sold on a commercial scale during the past several years by foreign corporations with which Resistoflex Corp. is indirectly affiliated.

The patented tubing is being used abroad in a number of applications, such as, fuel and brake lines and lubrication systems of automotive equipment, Diesel engines, and aircraft.

Automobile Manufacturers to Consider Industry's Problems

Problems affecting the motor industry will be considered by the members of the Automobile Manufacturers Association at the annual meeting in Detroit, June 9.

Topics and speakers include the following: "Our Progress and the Outlook," by Alvan Macauley, president, Packard Motor Car Co. and

president of the association; "Industrial Relations—1938 Model," by William S. Knudsen, president, General Motors Corp. and chairman of the association's Manufacturers Committee; "How Washington Views the Future," by Pyke Johnson, A.M.A. vice-president; "To Junk or Not to Junk?" by Richard H. Grant, vice-president, General Motors Corp. and chairman, Sales Managers Committee; "The Business Outlook," by Benjamin M. Anderson, Jr., chief economist, Chase National Bank of New York.

UAW Reports 1937 Expenses At \$1,587,561

Total expenses of the United Automobile Workers Union for 1937 were \$1,587,561 and receipts were \$1,770,450, according to the semi-annual report and audit supplied to UAW locals by International headquarters. The union's treasury balance on Dec. 31, 1937, was \$182,889 as compared with \$428,779 on June 30, 1937.

Per capita taxes paid into the international treasury during the last six months of the year totaled \$565,002 which has been interpreted to indicate an approximate paying membership of 269,000, although this does not account for non-paying unemployed members and is complicated further by the fact that there was a rush of per capita payments for representation at the international convention last fall.

Major expenditures during the last six months included: Per capita payments to the national CIO, \$82,513; Ford organizing drive, \$73,904; salaries of officers, organizers and office employees, \$231,009; expenses of officers, organizers and office employees, \$144,102; UAW newspaper, \$77,955; donations to strikes, \$42,494.

Salary of Homer Martin, president, was indicated as \$1,961, and \$2,794 expenses during the six months. Vice-presidents were paid salaries and expenses as follows: Richard T. Frankenstein, \$1,739 and \$1,482; Wyndham Mortimer, \$1,827 and \$2,475; Ed Hall, \$1,846 and \$1,683; Walter N. Wells, \$1,904 and \$1,546; R. J. Thomas, \$1,230 and \$552.

Correction

The Ford Motor Co.'s new tire factory at its Rouge plant in Dearborn, Mich., was incorrectly located at Riverview, Mich., in an item published in last week's AUTOMOTIVE INDUSTRIES, page 710. A brief story on the new plant in this issue, page 739, will be supplemented by a detailed description to appear in a subsequent issue of AUTOMOTIVE INDUSTRIES.

Drew Highway Plan

(Continued from page 743)

press highway will be built connecting Pittsburgh and Harrisburg and urged the conferees to push for similar legislation in their respective states. It was recalled, however, that the Pennsylvania super-road would be built along an abandoned railroad right-of-way so that its chances for being a self-liquidating road are deemed to be infinitely greater than if condemnation proceedings had been necessary.

The meeting attracted some attention not because of any likelihood of the plan being carried forward on a nation-wide scale but because such a road would serve as a model highway to demonstrate the feasibility of similar roads running through congested areas.

Drew called the conference after consulting with President Roosevelt and WPA Administrator Hopkins. Conferees included Samuel W. Marshall, chief highway engineer of Pennsylvania, W. W. Mank, Delaware highway engineer and Nathan L. Smith, Maryland highway engineer.

Detroit Harvester Acquires Prestole Devices, Inc.

Announcement has been made by Harry L. Pierson, president of the Detroit Harvester Co., manufacturers of automotive parts and farm implements, that his company has ac-

quired the business of Prestole Devices, Inc., Detroit. The latter company is reported to have made rapid progress over the past two years in the manufacturing, marketing, and licensing-to-manufacture of sheet metal fastening devices for the automotive, household appliance, and sheet-metal-working industries. The Prestole fasteners are controlled by a number of U. S. and foreign patents, both issued and pending.

Manufacturing operations are continuing at the Prestole plant, 2679 E. Grand Boulevard, Detroit, with certain operations being transferred to Detroit Harvester Co.'s Dura Division at Toledo. Harold W. Kost, former Prestole president, becomes head of Harvester's Prestole Division.

warned quasi-judicial agencies of the necessity of full and fair hearings before taking final action against alleged violators. The Board steadfastly maintained from the first that its orders were not imperiled by the court but nevertheless has moved promptly to correct the procedure where there was some doubt that it might run counter to the court's view.

The high court's decision on Tuesday held that the Circuit Court was without jurisdiction in the Republic case since the transcript of the record had not been certified and the NLRB in the Ford case pursued a similar line of reasoning, insisting that the Sixth Circuit Court of Appeals at Covington, Ky., also was without jurisdiction. The Board explained that the record had not been certified in the Ford case in view of further proceedings pending in which the Ford Motor Co. is involved.

On Tuesday the Board asked the court at Covington to deny the company's petition which sought information as to whether certain CIO lieutenants and New Deal brain trusters were consulted prior to issuing the order against the Ford Co. The NLRB reiterated its statement that the petition was not made in good faith but for the purpose of conducting "a private and unlimited fishing expedition into the affairs of the Board."

Ford-NLRB

Labor Board Moves to Reopen Case Against Company

The National Labor Relations Board went forward with plans on Wednesday to re-open its case against the Ford Motor Co. after the Supreme Court ruled the day before that the Third Circuit Court of Appeals in Philadelphia acted without jurisdiction in restraining the Board from withdrawing its order against the Republic Steel Corp.

The NLRB had taken steps to reopen both the Ford and Republic cases after the Supreme Court, in the Kansas City stockyards decision,

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

Foreign Motor Trials

Judging from the number of competitions, races and exhibitions that have been crowded into the last month abroad, interest in the new motor is in no danger of lagging there. The tests for heavy wagons at Liverpool were no sooner ended than the cab trials at Paris began, to be followed after a short interval by the international exhibition in the same city. Considered singly these events demonstrate, first, the practicability of the steam wagon for heavy haulage; second, the feasibility of an electric cab system for the city of Paris, and last, the motor vehicle as the magnet of the hour in the French capital. He must be indeed hard to convince who longer doubts that an industry of colossal proportions is developing here.

From *The Horseless Age*, June, 1898.



Acme photo

CINEMOTOR THEATER

—Motoring and motion pictures combine in this Drive-In theater in Los Angeles, Calif. The theater is a park-

ing lot which is arranged so that motorists, in their own cars, can watch films projected on a giant screen. Synchronized amplifiers are located in front of each parking space.

Automotive Metal Markets

Uncertainty as to When Automobile Manufacturers Will Place Tonnage Orders Clouds Steel Market Sentiment

Uncertainty was unrelieved in the metal markets following resumption of business after the Memorial holiday. The unknown that gives greatest concern to the steel industry is the time when automobile manufacturers will again come into the market with tonnage orders. That a return to more normal conditions in their own industry is predicated upon no factor more so than a quickening of activities in the automotive field, was the thought generally expressed by steel producers in attendance at the sessions of the American Iron & Steel Institute. Especially from the smaller steel company executives, who came to New York for these meetings, were heard expressions of prayerful confidence that, as frequently in the past, automotive demands would before long turn the tide.

Study of the lists of revised extras has not altered the first conclusion that, due to the offsetting of upward by downward changes, the cost of steel in an automobile remains virtually unchanged. Reduction of \$2 per ton in the base price of cold rolled strip has, however, directed attention to that description of steel, and there is also a possibility that buyers may take advantage of minor savings on certain sizes during the remainder of June, when they still have the choice between old base prices and extras and the new set-up. On the whole, however, little change in the rate of buying by automobile manufacturers and parts makers is looked for in the next few weeks. For the current five-day week, the American Iron & Steel Institute's estimate of the rate of ingot production is 26.1 per cent of capacity.

To the uncertainty over when there would be a revival of demand from automotive consumers, non-ferrous metal producers and importers had other worries added. Announcement of the result of the buffer pool referendums overhangs the tin market. According to a Reuter dispatch from Kuala Lumpur, Federated Malay States, it was to be made public following this week's meeting of the International Tin Committee at The Hague. Over Decoration Day, when the New York tin market was closed, London ran prices sharply upward, with the result that when business was resumed here on Tuesday, importers quoted spot Straits at 36½ cents, compared with 35.70 cents at

the preceding week's close. American consumers generally, however, continued offish.

In the copper market considerable surprise was caused by revelation of a sharp reduction in foreign holdings of refined copper. These figures had been held up by Europe about two weeks, presumably because they reflect much heavier buying for armament than in March. European copper buyers interpreted the recent reduction in the price of electrolytic from 10 to 9 cents as indicating the possibility of further price cuts. Closing down of several mines by the largest producer strengthened this impression. In spite of this, London chalked up higher prices on Monday and the export price in New York on Tuesday stood at 8½ cents, about ¾ cents higher than last Friday. Consuming interest, however, is light and, aside from routine transactions between producers and their fabricating affiliates, the volume of buying is virtually nil. Electrolytic continues to be quoted at 9 cents in the domestic market.

Zinc and lead continue rather dull. Following a \$5 per ton cut in the price of lead late last week, better interest on the part of storage battery manufacturers is expected to develop in the next few days.—W. C. H.

South Bend

(Continued from page 743)

Motors Corp., General Motors Sales Corp., General Motors Acceptance Corp., E. W. Berger, George F. Benkhart, M. E. Coyle, James D. Deane, Nelson C. Dezendorf, August Freise, Richard A. Grant, Roy Hill, W. E. Holler, W. F. Hufstaeder, H. J. Klingler, William S. Knudsen, Russell Lesser, Ralph W. Moore, W. J. Mougey, Arthur B. Purvis, John J. Schumann, Jr., Alfred P. Sloan, Jr., General Motors Board, and G. I. Smith.

Comment among some of the leaders in Washington following the indictments was divided. Some welcomed the course taken and expressed the hope it would produce a salutary effect on other large industries, and others believe the matter would be settled by compromise or consent decree.

Among those to laud the indictments was United States Senator James E. Murray of Montana, who as a member of the special Senate committee on unemployment and relief has been questioning many

American industrial and banking leaders on the causes of the recession. "Federal grand jury indictments returned in South Bend against automobile magnates should have a salutary educational effect upon other big industries as well as the automobile business," Senator Murray said. "Big business talks about Government interference with free competition. Why we haven't got free competition in this country. This is shown by the indictments charging the big motor companies with conspiring to promote monopoly by coercing dealers to finance car sales through the companies' own finance companies. I believe the Government intends to get rid of monopolies in every line."

The automobile companies were defended by United States Senator Clyde L. Herring, former Governor of Iowa, who as head of the Herring-Motor Co., was Ford's chief representative from Iowa. Recalling his many years of experience in the industry Senator Herring said that "no dealer has told me that he has been influenced to finance in any one company. In the event that any company may be technically guilty of breaking monopoly law the remedy would seem to be an equity case under which they could be penalized and pay damages instead of finding themselves confronted with the present criminal indictments. I can't see that they should be indicted. I am not in sympathy with a criminal action case of that kind."

Representative Gardner R. Withrow, Wisconsin Progressive, author of the resolution under which the Federal Trade Commission is now preparing a report to Congress on the relation between automobile manufacturers and dealers, said: "I am very keen for the breaking up of these large monopolies. They have no place in a sound Government. Their abolition is the only hope for preservation of our profit system. I am satisfied with developments, I confidently believe the pressure is going to be off the local dealer. The manufacturer will no longer dare to glut the used car market by forcing new car sales."

New Detroit Branch Office for H. A. Wilson Co.

The H. A. Wilson Co., Newark, N. J., manufacturers of Wilco thermostatic bi-metals and contact materials, announces the opening of a factory branch at 422 New Center Bldg., Detroit, Mich. Marshall Ward will be branch manager.

Economies May Delay Adoption Of New Automotive Rubber Devices

The rubber and tire industry apparently will have to wait at least another year to have some of its newest rubber inventions adopted as even optional equipment by automobile manufacturers. Word from Detroit to major Akron tire manufacturers who supply the bulk of original equipment tires and mechanical goods for automobiles, indicates that car makers are not contemplating any radical change in design and construction of 1939 model cars so as to permit the use of rubber suspension installations in place of steel springs. Neither will car manufacturers, for another year at least, increase their production costs by replacing the conventional upholstering material in cars with the new and more costly rubber latex and sponge rubber seat cushions.

Automobile manufacturers indicate that the trend in construction and design will be in the direction of simplicity and lowered costs, with careful avoidance of use of any new rubber or other gadgets which may cause radical changes in design and increase construction costs.

Firestone Tire & Rubber Co. has been the leader in development of rubber springs to replace metal springs. The company now is building a steel products plant at Riverview, Mich., for the manufacture of rims and also for the manufacture of the new rubber springs.

Three Tool Companies Sign Dealer Contracts With Vascoloy-Ramet

The Tungsten Carbide Tool Co., division of the Michigan Tool Co., the Midwest Tool and Mfg. Co., and the Morse Tool Co., all of Detroit, have signed dealer contracts with Vascoloy-Ramet Corp., North Chicago, Ill.

Chrysler First Quarter Profit Reported At \$2,109,969.52

Reporting on the first three months of 1938, the Chrysler Corp. shows a net profit, after all charges, of \$2,109,969.52, which is equivalent to 48 cents per share of common stock outstanding. For the first quarter of 1937 the net profit totaled \$10,914,302.99, or \$2.51 per share.

Cash and marketable securities at March 31, 1938, were \$64,217,642.88, an increase of \$15,904,067.21 during the quarter. Inventories decreased \$10,308,572.55 during the period. Net current assets at March 31, 1938, amounted to \$79,112,434.08, an in-

crease of \$5,057,617.28. Depreciation and amortization of \$2,740,949.11 were charged to operations during the quarter, and net property, plant and equipment decreased \$1,764,271.76 to \$64,300,201.43 at March 31, 1938.

Willys Reports Loss For First Quarter

A net loss of \$203,246 for the first quarter of 1938 has been reported by Willys-Overland. The company

showed a profit of \$15,024 in the previous quarter. However, Willys' strong financial situation as of March 31, 1938, was indicated in the balance sheet which showed current assets of \$4,441,924 against current liabilities of \$1,335,810. Current assets consisted of \$1,492,241 cash, \$308,700 receivables, and \$2,640,981 inventory. The company has no bank loans, and its net working capital was reported at \$3,106,113.

Englishwoman's Invention Adopted by Wolseley

On the 25 hp. Wolseley limousine and coupe recently introduced in England, the standard equipment includes a thermostatically controlled cylinder-wall lubricator invented by a prominent woman motorist, the Hon. Ruth Cokayne. Patent rights were originally secured by the S. U. Carburetor Co. for use in conjunction with the S. U. thermostatic starting-mixture control, but the device has now been made available for all makes of carburetors.

Known as the Thermoil cold-start lubricator, it consists of a "bottle" fitted under the hood containing sufficient lubricant for approximately 2000 cold starts. The outlet leading to the induction manifold is opened and closed by a thermostatically operated valve that remains open so long as the cooling water temperature is below 95 deg. Fahr.

The selling rights have been acquired by Alexander Duckham & Co., who offer it for use with their "Adcayne" upper cylinder lubricant, which embodies a wax-like substance that also is sold in the form of cubes, known as "Adcoids," for insertion in the gasoline tank.

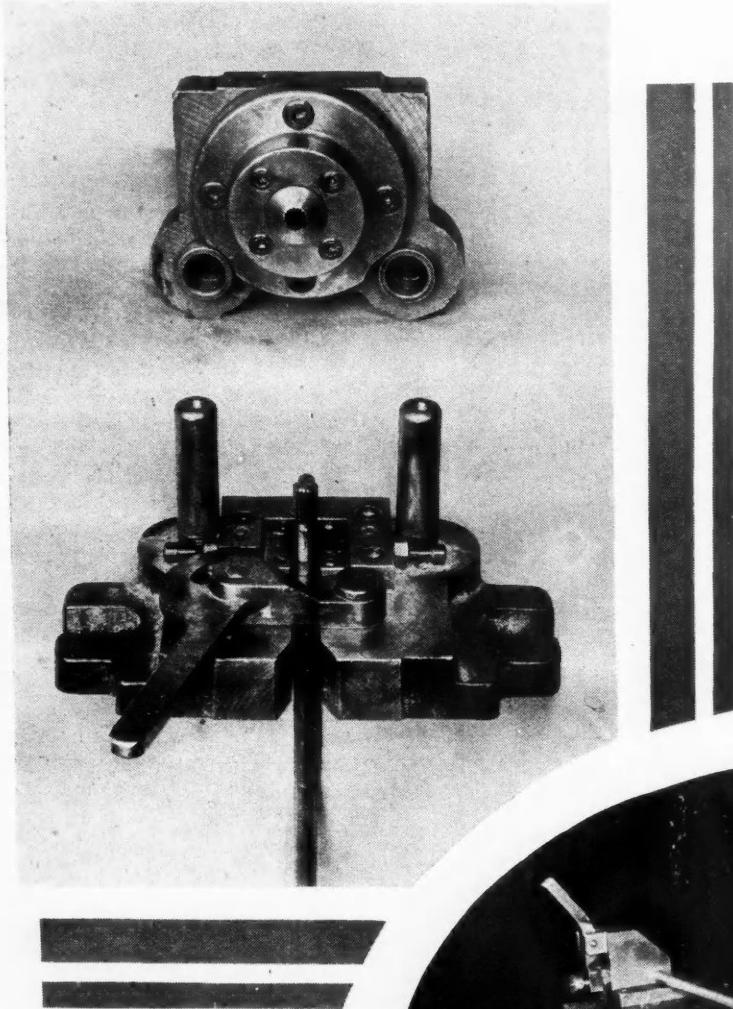
April Pneumatic Casing Shipments Increased 11.2% Over March

Shipments of pneumatic casings during April, 1938, estimated at 3,199,363 units, increased 11.2 per cent over shipments made in March but were 42.5 per cent under shipments for April, 1937, according to statistics released by the Rubber Manufacturers Association, Inc.

The association estimates production of pneumatic casings during April at 2,705,606 units. This is a decrease of 1.9 per cent under March and 52.8 per cent under April, 1937.

Pneumatic casings in the hands of manufacturers, April 30, 1938, are estimated at 10,316,774 units, a decrease of 4.5 per cent under the stocks on hand March 31, and 18.3 per cent under the stocks on hand, April 30, 1937.

Ingenious Factory Methods



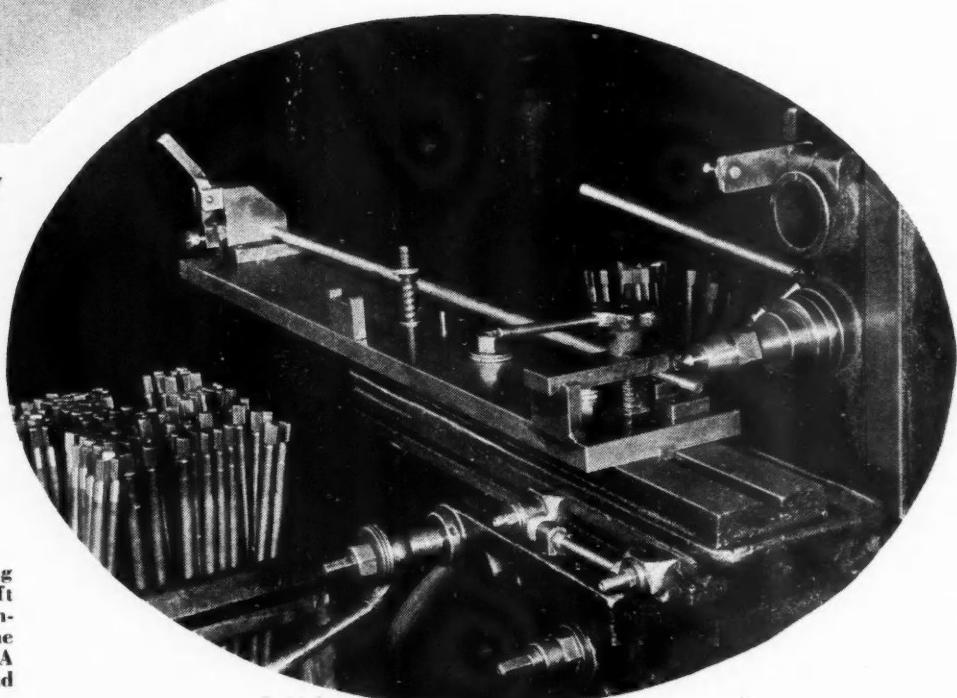
(Above) Die developed at Monmouth Products Corp. for shearing serrations on one end of gear shift control shaft.

(Oval) Set-up for milling locking flat on serrated end of gear shift control shaft manufactured by Monmouth Products Corp. The machine is a No. 6 Whitney hand miller. A keyway is milled at the opposite end of the rod on the same machine.

By H. E. BLANK, JR.

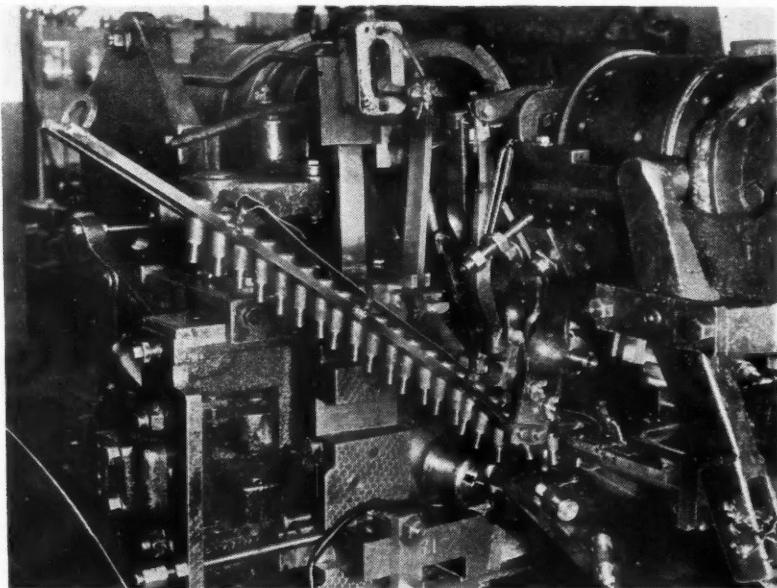
AMONG numerous parts supplied to the automotive industry by Monmouth Products Corp., Cleveland, there are two now in production which required considerable ingenuity in preliminary planning and the design of special equipment to facilitate their manufacture. The parts referred to are ball studs for automobile tie-rod assemblies, and a gear shift control shaft.

A new method was adopted by Monmouth about a year ago for the manufacture of ball studs. While two types of ball studs are made, a full-ball and a half-ball stud, present production consists mainly of the half-ball type. Both are machined from cold upset studs which accounts for a saving of approximately 50 per cent in material costs as compared with the former practice of machining the studs from bar stock (the stock now used is SAE 3115



THIS IS THE TWENTY-SIXTH IN THE SERIES OF MONTHLY PRODUCTION FEATURES WITH descriptions of the Monmouth Products Corp., the National Screw & Mfg. Co. and the Eaton Axle plants.

at Monmouth Products are the result of preliminary planning and the evolution of special equipment



ground after it has been hardened, while the final operation on the half-ball type includes shaving and rolling in an automatic machine.

The gear shift control shaft is now being made from SAE 1112 steel stock and in the first operation, which is performed on a No. 2 Warner & Swasey machine, the ends are formed and the shaft cut off. Eighteen serrations are then sheared on one end with the die shown on the facing page which was developed especially for the purpose. Shearing of the serrations is accomplished on a Stoll punch press geared down considerably for the operation.

Monmouth engineers experimented
(Turn to page 770, please)

(Left) Close-up of special attachments on 4-spindle Cone automatic to facilitate production machining of cold-upset ball studs for tie-rod assemblies at the plant of Monmouth Products Corp.

steel). Use of the cold upset studs also doubled the possible production rate, and peak production with present equipment is estimated to be approximately 5000 studs in a 24-hr. period per machine.

Machining operations are performed on four-spindle cone automatic machines. The studs are placed in an inclined magazine which feeds them automatically into the machine. Collets were especially designed for the job and are constructed to hold on the taper of the stud. After the stud is machined it is ejected automatically, the chucking device being disengaged by a cam. A close-up view of the magazine adapted to the Cone automatic machine appears on this page.

A cotter pin hole is drilled in the thread end of the studs after they have been machined. They are car-

burized at 1650 deg. Fahr. in a Hevi-Duty carburizer, quenched in oil, and the shank is annealed. Monmouth's carburizing equipment is of the latest type manufactured by the Hevi-Duty Electric Co. in Milwaukee.

The ball of the full-ball stud is



Half-ball studs for tie-rod assemblies in production at plant of Monmouth Products Corp. At the left is a cold-upset ball stud prior to machining on Cone automatic. On the right is the finished product.

Even a prosaic line of nuts and bolts, comprising 11,000 specifications, lends itself to innovations of manufacturing procedure at the . . .

National Screw Company

THIS year The National Screw & Mfg. Co., Cleveland, observes its fiftieth anniversary, although the company originally began as the Union Screw Co. more than 80 years ago. National's line has grown rapidly and today the various sizes and types of bolts, screws, rivets, cotters and nuts which it manufactures total over 11,000 different specifications. Important consumers of these products are the automotive and allied industries; the automotive industry alone taking between 40 and 45 per cent of the company's special output.

A newcomer to National's line is the Phillips screw with the patented recessed head which has been adopted by several large producers of motor vehicles for standard fastenings of parts such as interior trim and body fittings. The original patents on the Phillips head are held by the Phillips Screw Co., Portland, Ore., and National was licensed to produce it in December, 1937. Other manufacturers making this product at the present time include the American Screw Co., licensor, Providence, R. I.; the Continental Screw Co., New Bedford, Mass.; the Corbin Screw Corp., New Britain, Conn.; the Parker-Kalon Corp., New York; and the Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

Three photographs on the adjoining page show some of the new equipment recently installed in the cold-heading, the roll-threading, and the semi-finish nut departments at the National plant in Cleveland. The heat-treating department in this

plant also contains some of the latest equipment, including heat-treating furnaces made by the Electric Furnace Co., Salem, Ohio. National engages in virtually every type of commercial plating, ranging from galvanizing to gold plating. Most of the

plating is done by the barrel method, although the still and rack processes are also used. At the present time, most of the plated products are either galvanized or cadmium plated. Nickel and bright zinc plating are next in importance.

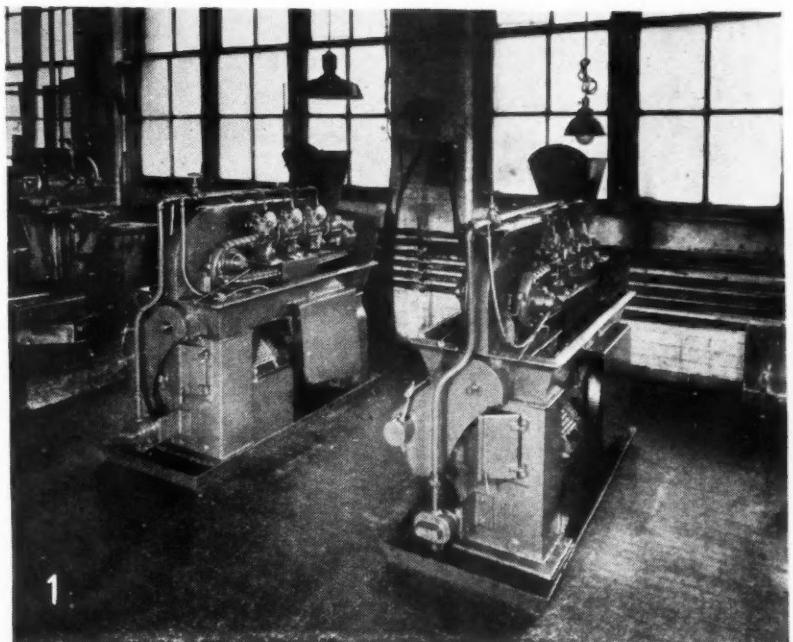
1 In the semi-finish nut department at the National Screw & Mfg. Co. plant these saw-type slotting machines for castellating nuts were installed within the past year. The equipment is a product of the Pellow Machine Co., Detroit, and it is reported that each unit will produce approximately 3000 castellated nuts per hour. The conveyors on these machines comprise a number of collet sockets into each of which a nut collet stem is inserted. In operation, when the nut passes the first saw, the collet turns in its socket 60 deg., and is aligned by guide rails for the second slot. Indexing occurs again between the second and third saw. A safety gage attachment makes it impossible for an improperly located nut to advance to the saws and also prevents passage of any oversize blanks through the machine. A burr removing attachment operates in conjunction with the slotting operation.

2 The roll-threading department at National Screw & Mfg. Co. contains a number of very modern machines. Shown here is a battery of Waterbury-Farrel chain feed, hopper-type, roll threaders. The process of thread rolling simply involves rolling a bolt or screw blank between two dies, the faces of which contain thread grooves corresponding to the helix angle of the screw thread. Thus, the surface material of the blank is cold-forged into thread form—no metal being removed and the core of the blank remaining undisturbed. It is claimed that a thread so formed is from 15 to 20 per cent stronger than a cut thread. The chief advantages of the process of thread rolling are greater uniformity, no waste of metal, and increased production at less cost, plus accuracy and strength.

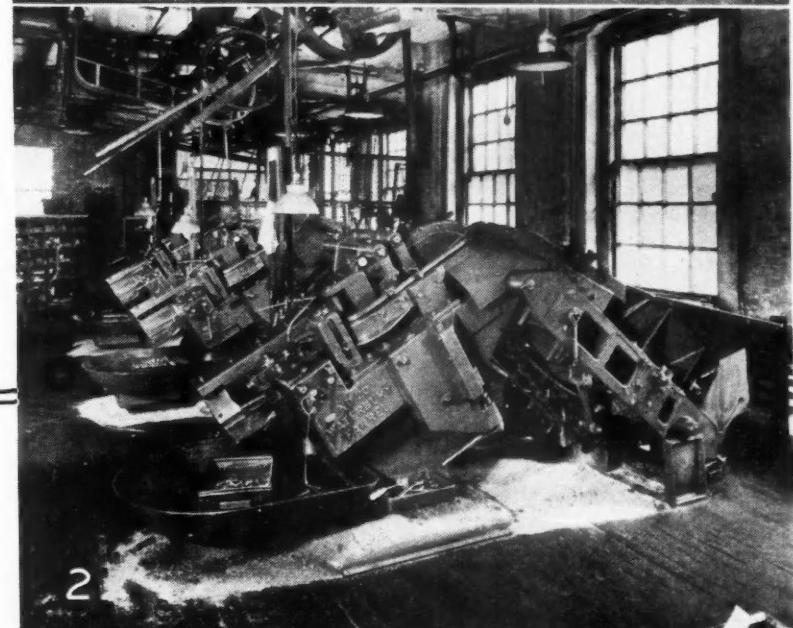
Plant

The company is headed by H. G. Alexander, president, and C. F. Newpher, vice-president, while the production personnel consists of L. S. Cope, general manager; H. C. Erdman, mechanical engineer, and H. L. Hopkins, metallurgist.

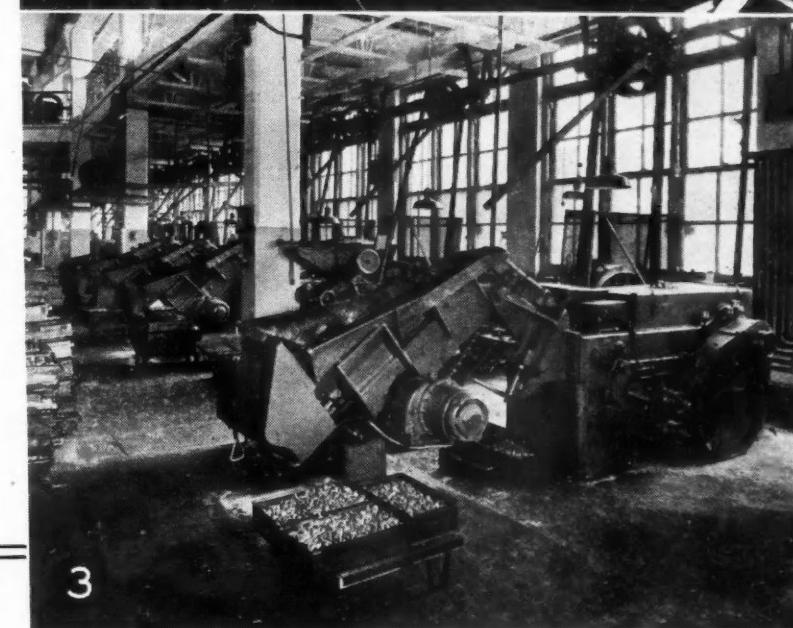
3 A battery of Waterbury-Farrel bolt trimming machines in the cold-heading department of the National Screw & Mfg. Co. plant. Some of these comparatively modern machines were equipped a short time ago with recently developed chain feed hopper attachments. Blanks placed in the hopper are agitated by a spiral cam which keeps them in motion to facilitate their being picked out of the mass by fingers attached to a moving chain. The blanks are carried by these fingers up an inclined passage into the machine. As the blanks move up the incline the excess is brushed away by a series of knock-off rods, and two cam plates positioned near the top of the hopper serve to prevent passage of any blanks which are improperly located. Chain drive is by gear motor through adjustable spring tension friction which is intended to prevent breakage should one of the blanks jam and stop the movement of the chain. If the feed chute is full or should clog, a monitor device is provided which actuates a trip mechanism and stops the feed until the magazine requires additional blanks or the obstruction is removed. The blanks are trimmed by the pressure of a moving die against the nose of a stationary punch.



1



2



3

Eaton Axle Has Unit Production

THE Eaton Axle Division of the Eaton Mfg. Co., Cleveland, spreads its manufacturing activities over a plant area of more than 300,000 sq. ft. and utilizes an estimated \$2,500,000 worth of machinery and related equipment to produce commercial vehicle front and rear axles.

Separate production lines are set up in this plant for the manufacture of individual parts. A single, continuous production line would not be feasible due to the multiplicity of sizes and types of parts made, whereas the separate lines are sufficiently flexible to accommodate the different types and sizes of individual parts such as the pinion bearing cage, the rear axle housing, the differential carrier for double reduction axles, and the differential case for two-speed axles. These four have been selected for description here because they are typical of line operations throughout the Eaton axle plant.

In the production of the rear axle housing the first operation is spraying of the unit with paint. It is then set up on a hydraulic boring machine for boring, reaming tube diameters, and facing of the ends to length. Flange and felt diameter are turned and faced on a center-drive double end lathe. Immediately following both carrier and cover sides are faced. The last-mentioned operation is done on a heavy-duty vertical drilling machine. Spring pads are milled on a hydraulic rise-and-fall special milling machine made by Eaton and—on a three-way multiple drill—the flange, dowel and lock screw holes are drilled.

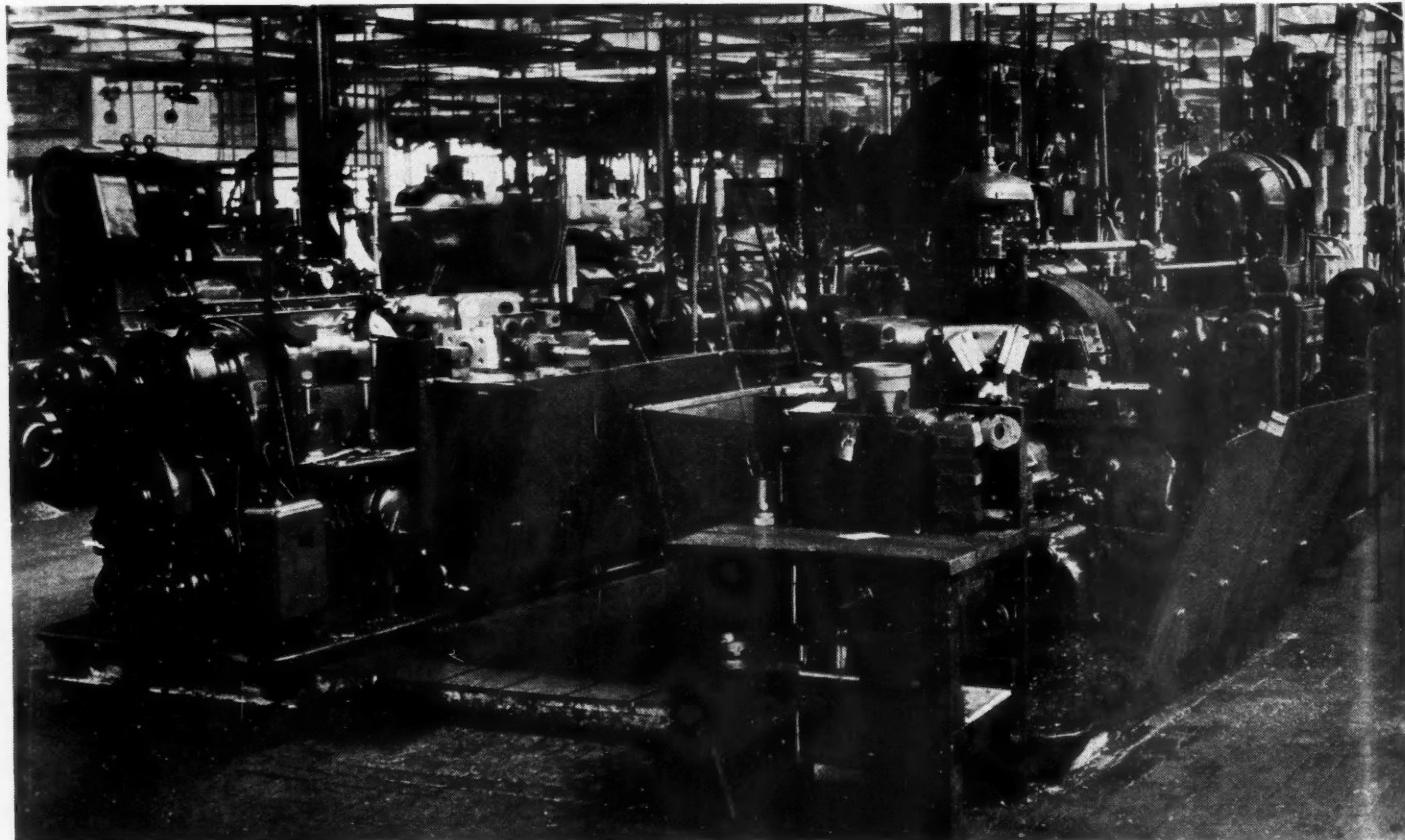
Carrier and cover holes are drilled on a two-way multiple drill, after which the carrier and cover holes are chamfered and tapped on a two-way multiple tapping machine. Subse-

quently, three 7/16 in., 14-pitch holes are drilled and tapped in the carrier face on a sensitive radial drill. On another radial, two $\frac{5}{8}$ in. 11-pitch lock screw holes are spotfaced and tapped. The $\frac{3}{4}$ in. pipe hole is then drilled and tapped.

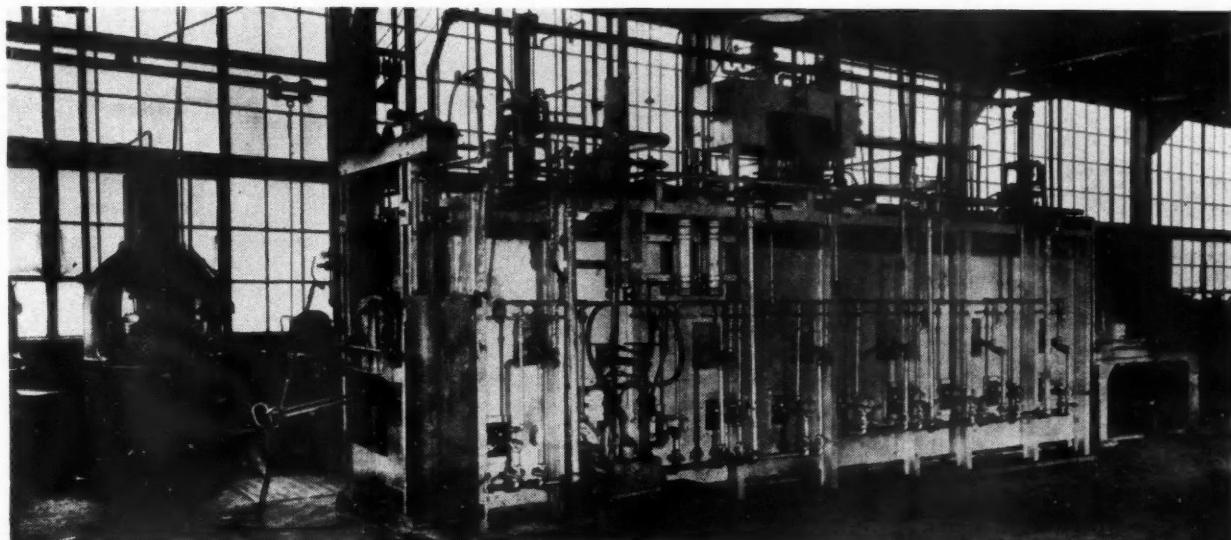
Final operations on the axle housing are finish turning of the ends on an engine lathe with two carriages, and blowing both ends clear of chips.

The first operation in production of the differential case is to spray the case with sealer, then—on an automatic turret lathe—the bore is roughed out and finished and the face form turned and chamfered. The piece is taken to the diamond boring machine for finish boring of the spherical face. Carboloy boring is used in this operation because high accuracy and fine finish for the side pinion seats are desired.

Overall view of production line for differential case at the Eaton Axle Division plant of Eaton Mfg. Co. In the foreground are two late model turret lathes.



Lines for Individual Parts



Operations on the Pinion Bearing Cage

Oper.

No. Details of Operation

1. Rough and finish face both sides of flange. Turn flange outside diameter, rough and finish bore, Trepan face groove, chamfer flange and ream hole.
2. Rough and finish hub end, rough and finish turn hub, rough and finish bore hole, form groove on flange outside diameter chamfer bore and ream bore.
3. Finish bore (2) bearings. Drill (6) flange holes.
4. Drill $\frac{5}{8}$ in. diameter hole and burr.
5. Drill $\frac{3}{8}$ in. diameter hole and burr.
6. Countersink (6) flange holes both sides. Countersink both sides of $15/64$ in. dia. hole and ream (1) hole to (0.246-0.248) diameter.
7. Press in cups.
8. Grind outside diameter and face.

Machine

Acme Gridley semi automatic.

Acme Gridley semi automatic.

Heald Eorematic.

Fox multiple drill.

24 in. Cincinnati drill.

24 in. Cincinnati drill.

21 in. Cincinnati drill.
Avey (2) spindle drill.

Arbor press.

Norton grinder.

Ring gears eventually assembled into Eaton two-speed rear axles are carburized in this gas-carburizing furnace.

After the spherical face has been bored and finished the case goes to a drill equipped with a multiple head and 12 holes $23/64$ in. diameter are drilled. These holes are counterbored and tapped to $7/16$ in.—17 pitch. At this point in the sequence of operations the holes on the dowel face are scraped for burrs and chips are removed from blind holes. Spider slots are then milled. Four $11/16$ in. holes are drilled and spot-faced. Idler pinion clearance is machined and the idler pinion bosses faced. The four $1\frac{1}{16}$ in. holes are redrilled to $1\frac{3}{32}$ in. and four $17/32$ in. holes



Operations on the Differential Carrier

Oper. No.	Details of Operation	Machine	Oper. No.	Details of Operation	Machine
1.	Rough and finish face flange and pedestals. Drill flange and pedestal holes. Countersink flange and pedestal holes. Burr and blow out chips.	Gisholt simplematic. Natco multiple. Air motor. Bench.	4.	Tap shifter cover face holes. Drill 19/32 in. hole; spotface 1 1/8 in. hole, chamfer and ream (0.628 in.-0.630 in.). Tap 11/16 in. — 16 pitch hole, drill 25/32 in. hole, ream (0.814 in.-0.817 in.) hole and spotface 1 1/2 in. diameter.	Hammond tapper. Morris radial drill.
2.	Rough and finish bore, ream, face and chamfer pinion end. Drill pinion end holes. Countersink pinion end holes. Tap pinion end holes.	Potter & Johnston automatic. Natco multiple. Air motor.	5.	Spotface and back-spotface, counterbore and burr shifter boss inside.	24 in. Cincinnati drill.
3.	Mill clearance for bevel drive gear end differential bearing cap lug. Tap (4) pedestal holes. Drill and tap drain hole. Finish drill 3/8 in. hole in pinion end. Spotface (1) flange hole. Mill shifter cover face. Mill differential baffle. Mill stop boss. Drill shifter cover face holes.	24 in. Cincinnati drill. No. 2 Cincinnati mill. 24 in. Cincinnati drill. Minster drill. 2-spindle Avey drill. 2-spindle Avey drill. Pratt & Whitney auto. mill. Brown & Sharpe miller. Kent-Owens hand mill. Fox multiple drill.	6.	Broach keyway.	Lapointe broach.
			7.	Core drill, counterbore, spotface, ream and tap oil scoop hole. Drill, spotface and tap hole in oil scoop boss.	24 in. Cincinnati drill. 21 in. Cincinnati drill.
			8.	Assemble caps. Bore, ream and thread crossbore.	Bench and air motor. Barnes drill.

also drilled. All eight holes are reamed. Four more holes $\frac{1}{8}$ in. in diameter are drilled in the lugs and oil grooves are milled. Lastly, all burrs are removed.

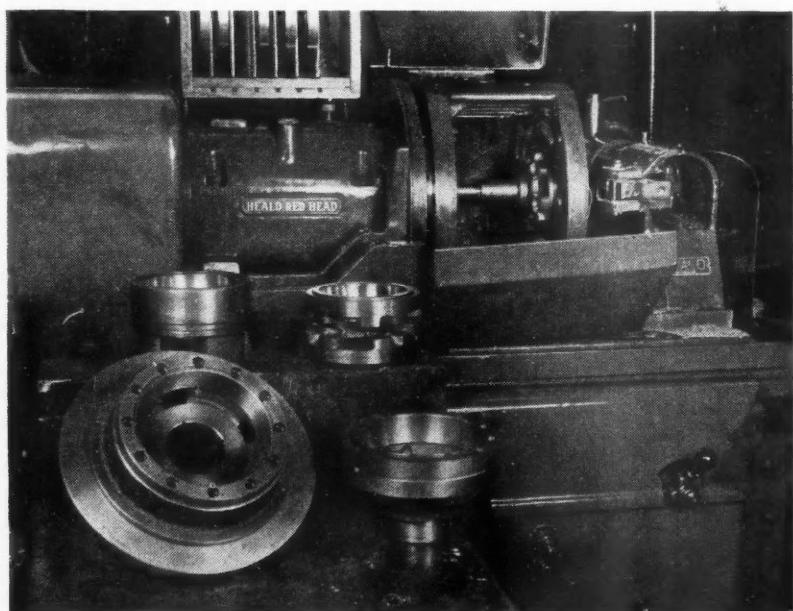
Operation sequences for the differential carrier and the pinion bearing cage are listed in tables on this and the preceding pages.

A very modern machine recently installed at the Eaton axle plant is a gas-carburizing furnace. It is used for carburizing ring gears which are later assembled into two-speed rear axles. The ring gears are stocked three-high on trays made of special heat-resisting alloy steel and two of these trays loaded with gears are introduced into the furnace every 45 min. They are permitted to remain in the furnace exposed to a temperature of 1700 deg. Fahr. for approximately 12 hr. and 45 min. With this exposure time a case depth is obtained ranging from 0.050 in. to 0.065 in. (Material from which these gears are made is SAE 4620 steel.) When the gears are hauled out of the delivery end of the gas-fired furnace they are cooled under cover to approximately 1500 deg. Fahr. and then oil-quenched in Gleason presses. The quenching oil is maintained at

a temperature of approximately 90 deg. Fahr.

As a manufacturer of automotive parts the Eaton Mfg. Co.'s record extends back to the early days of the

automobile industry and begins with the Torbensen Axle & Gear Co. which was founded and incorporated in New Jersey in 1911. This company (*Turn to page 768, please*)



Borematic machine used at Eaton Axle for finish boring the spherical face on the differential case.

Just Among Ourselves

Free Enterprise For Everyone

LAST week in Chicago, Paul G. Hoffman, president of Studebaker, joined the growing number of automotive executives who feel strongly enough about government encroachment in business fields to give public and serious utterance to their feelings on the subject. Mr. Hoffman has talked about the same thing before, but in the last few years his brilliant service to the cause of highway safety has thrust into the background a little his very earnest thinking about other forms of the public responsibility of business executives.

Mr. Hoffman spoke of "the Collective Responsibility of Business for Free Enterprise." He emphasized that business alone is responsible for the preservation of its political and economic liberties. He said many other things about the rights and duties of business under present conditions. But best of all, of the things he said, I liked his emphasis on the fact that "we must be consistent in our fight for freedom."

"We must fight against all unfair restraints," he said, "whether they apply to business, to labor, to farmers, or to individual citizens."

"We should make cause with the universities in their battle for academic freedom, with the newspapers for freedom of the press, and with the broadcasters for freedom of the air. We must convince the public that we sponsor free enterprise for everybody—not merely for our own profit-seeking operations—that we believe in free enterprise as a principle and not merely as a convenience."

"The American worker, for example, demands the right to organize freely in accordance with his own wishes. Business should not oppose it. Business should wipe out the last vestige of coercion against the free organization of its industrial employees. At the same time, and with absolute consistency, it should battle against new coercive forces operating against those same workers. I refer specifically to the closed shop and check-off. They are instruments of despotism and have no place in a free society. In actual practice, the closed shop and check-off deprive the individual

worker of the right to work unless he accepts full and complete dictation from a labor bureaucracy that may or may not represent the will of the majority. In any event, the liberty of the individual is sacrificed. If business believes in free enterprise, it must believe in it for the workers as well as for managements."

"Business must cease its migrations to Washington for succor. It isn't called 'succor,' of course, it is called 'cooperation'—a word on which I am completely fed up. We don't need more cooperation between business and government—we need less. Business should set an example of self-reliance—be ready to stand on its own feet and face its business problem. The government should go back to the task of governing."

I don't believe Mr. Hoffman, or his best friends, would claim any striking degree of originality for the thoughts in those paragraphs, but they are phrased with his characteristic vigor and conviction, and they are still rather rare from the mouth of a leading industrial executive.

The president of the United States has made every American conscious of the distinction between the means and the end in the attainment of social reforms. In American business everywhere, and particularly in the automotive industry, there is considerable evidence of a new brand of liberal thinking which is capable of believing in desirable ends without sacrificing the integrity of the means employed, or of the basically American idealism which defines the ends.

Roads—More Roads

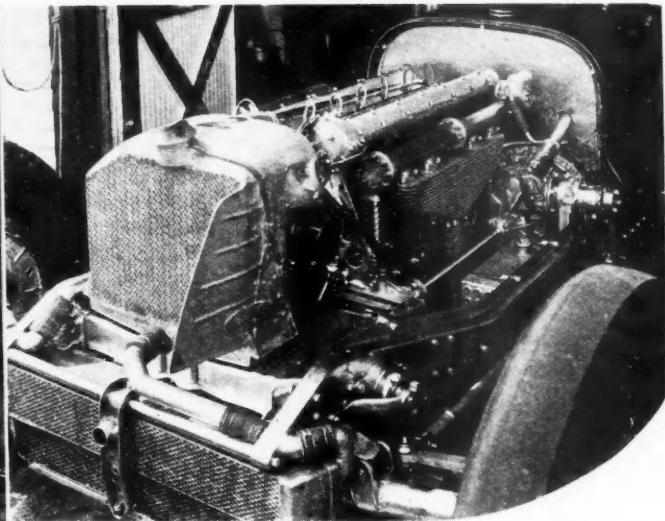
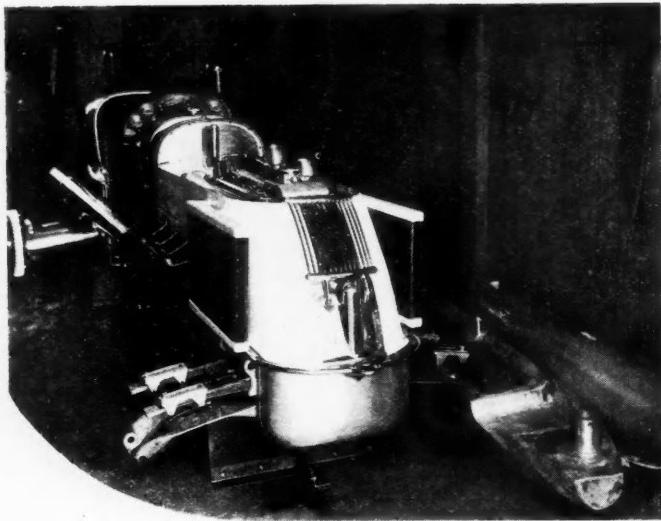
AS the discussion on "pump priming" and public works programs waxes and wanes, this observer becomes convinced more and more that aside from necessary conservation works, the construction of new and improved highway facilities is the one form of works program that is worth a damn from the standpoint of renewing economic activity.

Construction of many new Government buildings in Washington and the provinces is satisfying to the aesthetic senses (usually) and is undoubtedly comforting to the Government employes who work in them, but at best the buildings are a sort of colossal filing system for people and documents.

When a highway is built it carries with it social and economic potential. New towns, new industries, and new communications spring up around it. Socially it's the equivalent of building a high line for power transmission. Resistances to the movement of people and goods are broken down and its part of the history of America that where that has been accomplished, prosperity follows.

Buildings are static and highways are dynamic. Buildings are in the public eye, and highways are in the public interest. We, of all industries, should never forget it.

HERBERT HOSKING.



(Right) Sparks-Thorne six-cylinder models were driven by Snyder and Householder

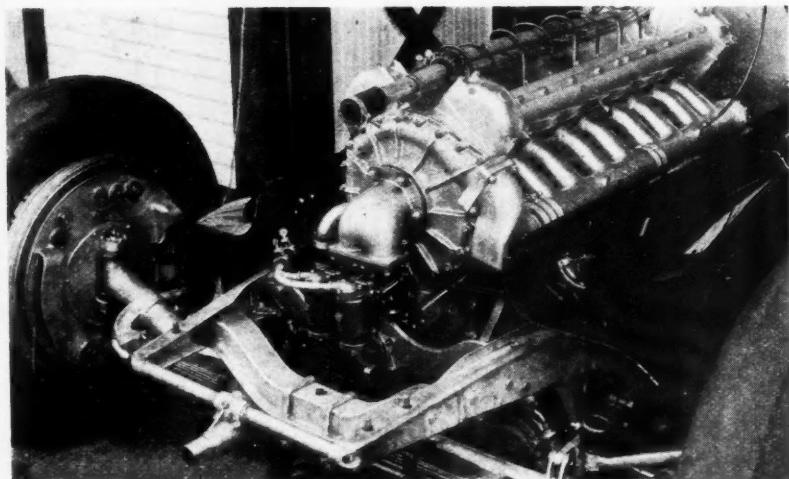
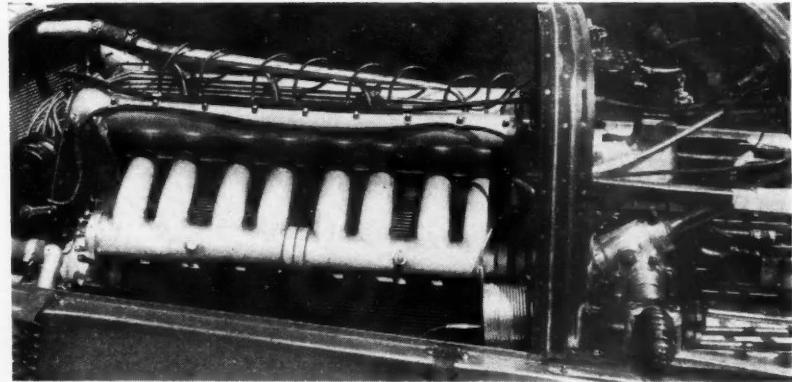
Four-Cylinder Non-Supercharged Cars

(Left) An interesting design innovation was this early arrival of Harry Miller's. It is a four-cylinder model.

Dominate Indianapolis

By CHESTER S. RICKER
Director of Timing and Scoring
at Indianapolis Race

THE "Five Hundred Mile Race" this year was not only a battle of drivers and machines but of several schools of engine and car design and types of fuel. With the new international rules allowing any type of fuel to be used, any quantity desired and superchargers on engines with less than 183 cu. in. displace-



(Above) Ted Horne drove an eight-cylinder, supercharged Miller of 182 cu. in. displacement. He made better than 121 m.p.h on his trials and finished fourth in the race with an average speed of 112 m.p.h.

(Left) Lou Meyer drove the Bowes Seal Fast Special, an eight-cylinder supercharged model. He was forced out of the race on the 149th lap through the failure of the oil pump

ment; of 274 cu. in. without superchargers, engine designers were given a free hand to try out new types and sizes. There were fours, sixes, eights, and a twelve cylinder engine. All engines had overhead

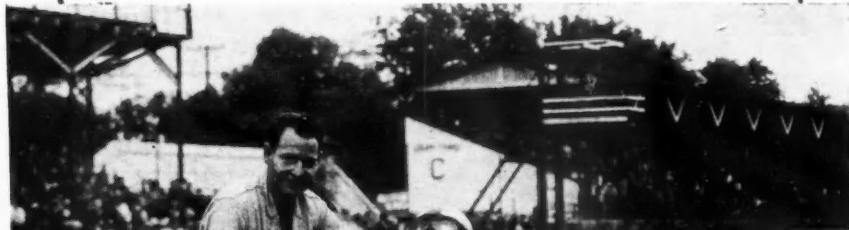
valves. Superchargers were used on most of the new engine designs under 183 cu. in. Front and rear drives strove for leadership, as well as alcohol-benzol fuel vs. ethyl gasoline—castor vs. petroleum lubricating oils.

For the first 74 laps the three supercharged, alcohol fuel jobs held the first three places at a 120-mile-an-hour pace. Then something happened and they relinquished the lead to Floyd Roberts in the winning Burd Piston Ring Special. It was no walk-over for him and he only held the lead to the 110th lap and then relinquished it to Jimmy Snyder in No. 6, the Sparks-Thorne Special. When Snyder went out Roberts again took the lead at 145 laps and finished 3½ min. or over two laps ahead of Wilbur Shaw, who was piloting the same car with which he won last year's race. Roberts finished in 4 hr. 15 min. 58.40 sec. at an average speed of 117.200 m.p.h., compared with 4

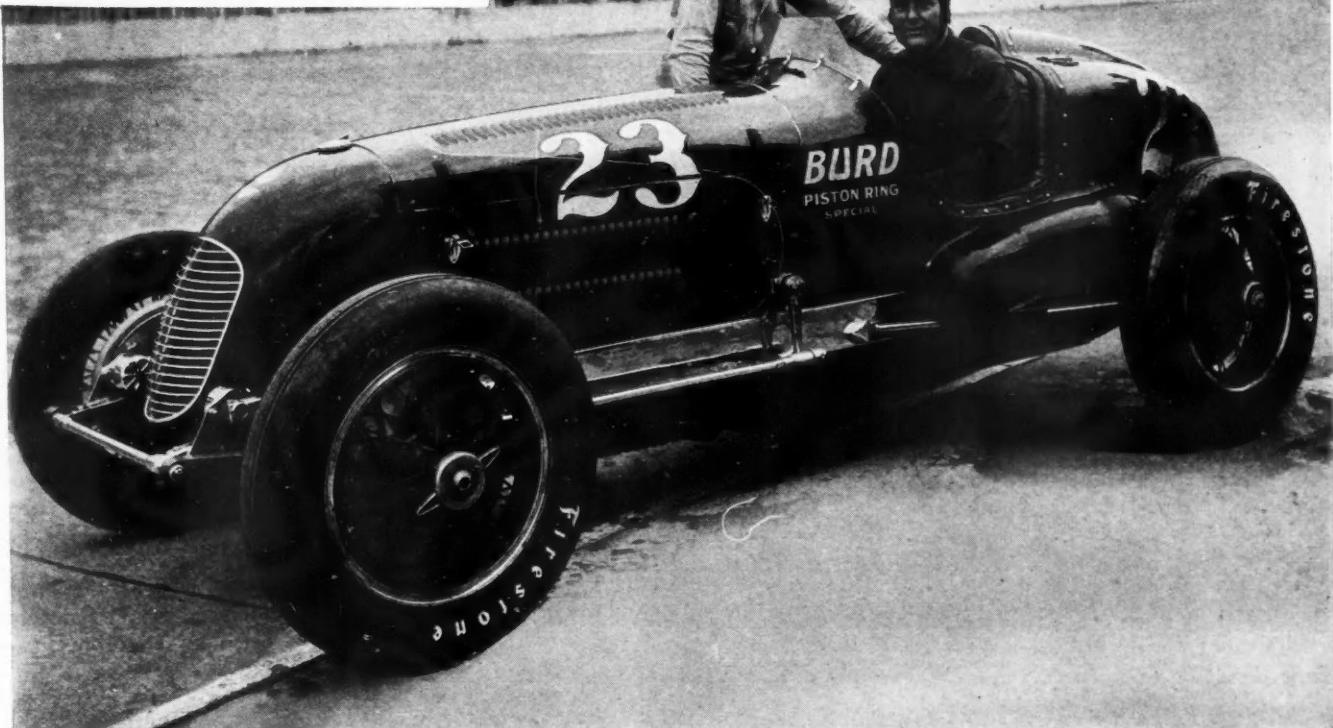
As They Finished

Finish Position	Driver	Number of Car	Car	M.P.H.	Cause of Withdrawal	Number of Pit Stops	In Lap No.
1	Roberts	23	Burd Piston Ring	117.200		1	
2	Shaw	1	Shaw Special	115.580		1	
3	C. Miller	3	I. B. E. W. Special	114.946		2	
4	Horn	2	Miller-Hartz	112.203		3	
5	Gardner	38	Burd Piston Ring	110.311			
6	Ardinger	54	Offenhauser Special	109.843		4	199
7	McQuillin	45	Marchese Special	108.694		3	197
8	DeVore	58	P. R. & W. Special	102.080		4	185
9	Thorne	22	Thorne Eng. Special	102.009		1	185
10	Wearne	29	Ind. Fur Co. Special	99.543		3	181
...	Nalon	43	Kohlert Special		Run. at finish	2	178
...	Meyer	5	Bower Seal Fast		Oil pump failure	5	149
...	Snyder	6	Sparks-Thorne		Bkn. blower hose	3	150
...	Cummings	7	I. B. E. W. Special		Rad. tank leaking	4	72
...	Mays	8	Alfa-Romeo		Frozen blower	1	45
...	Bergere	9	Kraft's Real Rye		Broken piston	2	111
...	Willman	10	Belanger Special		Broken valve	1	47
...	Bailey	12	Barbasol Special		Clutch failure	3	166
...	Snowberger	14	D-X Special		Con. rod broken	1	56
...	Connors	15	Marks-Miller Special		Engine trouble	2	119
...	Householder	16	Sparks-Thorne Special		Bkn. blower hose	4	154
...	Gulotta	17	Hamilton-Harris		Bkn. con. rod	3	130
...	Tomei	21	P. O. B. Perfect Seal		Bkn. con. rod	2	88
...	Brisko	26	Sure Stop		Broken oil line	1	39
...	Rose	27	I. B. E. W. Special		Blower frozen	4	165
...	Banks	33	Kimmel Special		Burned rod bear.	6	109
...	Stamp	34	McCoy Auto Special		Broken valve	1	54
...	Petillo	35	Petillo Special		Camshaft seized	1	100
...	Putnam	36	Troy-Tydot Special		Bkn. crankshaft	1	15
...	Hall	37	Greenfield S. S.		Eng. seized, wrkd.	2	44
...	Andres	42	Elgin Piston Pin		Bkn. wheel, wrkd.	1	45
...	Cantlon	47	Kamm Special		Blower loose	2	13
...	A. Miller	55	Domont's Special		Clutch failure	3	125

Finish



F. Roberts drove this four-cylinder Miller at an average over 117 m.p.h. to take first place.



Indianapolis Entrants

Car No.	Name	Driver	Engine Make	No. of Cylinders	Bore	Stroke	Displacement	Supercharged	Spark Plug	Ignition Cable	Piston Ring	Carb.	Wheel Suspension	Shock Absorber	Front Brakes	Rear Brakes	Fuel	Oil	Weight	Qualifying Time	Car No.				
1 Shaw Special	W. Shaw	Off.	4	4.260	4.500	256	N	C	B	P	P.C.	W	2	R	C	C	B	Gab	Gab	H	Gulf	1848	120.967	1	
2 Miller-Hartz Special	Ted Horn	Miller	8	2.875	3.500	182	Y	C	B	P	P.C.	W	2	F	C	C	H	Hart	Hart	M	Gil	1984	121.327	2	
3 I. B. E. W. Special	Chet Miller	Off.	4	4.250	4.500	255	N	C	B	P	Amer	M	1	F	C	C	D	Houd	Houd	M	Gulf	1855	121.898	3	
*4 Miller Special	R. Hepburn	Miller	6	3.500	3.125	180.5	Y	C	B	P	Amer	M	2	4	Ind	Ind	C	M	M	H-d	Gulf	2155	.....	*4
Miller Special	Billy Winn	Miller	4	4.250	4.500	255	N	C	BT	P	Amer	M	2	R	Ind	Ind	C	M-H	M-H	H-d	Gulf	1854	.....	
Miller Special	McD.	Miller	4	4.250	4.500	255	N	C	B	P	Amer	M	2	R	Ind	Ind	C	M-H	M-H	H-d	Gulf	1828	.....	
5 Bowes Seal Fast Special	Lou Meyer	Mey-Off	8	2.968	3.250	179.5	Y	B	B	P	P.C.	W	2	R	C	C	H	Hart	Hart	H	Gulf	1832	120.525	5	
6 Sparks-Thorne Special	J. Snyder	Sparks	6	3.187	3.750	179.4	Y	C	B	P	P.C.	W	1	R	C	C	A	Hart	Hart	H	Gil	2018	123.506	6	
7 I. B. E. W. Special	Bill Cummings	Miller	8	2.375	3.750	268	N	C	B	P	P.C.	M	4	F	C	C	D	Houd	Houd	M	Gulf	1875	122.392	7	
8 Alfa Romeo	Rex Mays	A-R.	8	3.000	3.200	180.9	Y	C	B	P	P.C.	Web	2	4	Ind	Ind	C	Hart	Hart	H	Gil	1878	122.845	8	
9 Kraft's Real Rye Special	C. Berger	Miller	8	2.625	3.500	151	N	C	B	P	P.C.	W	4	R	C	C	H	Hart	Hart	H	B	2144	118.458	10	
10 Balanger Special	T. Willman	Miller	8	3.312	3.750	258	N	C	B	P	P.C.	W	4	R	C	C	B	Hart	Hart	H	Gil	1760	114.464	9	
12 Barbabos Special	Geo. Bailey	Duray	4	3.810	4.000	183	Y	C	B	P	P.C.	D	1	R	C	C	B	Lov	Lov	M	Gil	1950	116.393	12	
14 D-X Special	R. Snowberger	Miller	4	4.260	4.500	256	N	C	B	P	P.C.	W	2	F	R	C	C	Houd	Houd	M	D-X	1880	124.027	14	
15 Marks-Miller Special	G. Connors	Miller	4	4.275	4.360	266	N	C	B	P	P.C.	W	2	R	C	C	D	Hart	Hart	M	Gulf	1884	120.326	15	
16 Sparks-Thorne Special	R. Householder	Sparks	6	3.187	3.750	179.4	Y	C	B	P	P.C.	W	1	R	C	C	A	H-H	H-H	H	B	2002	125.769	16	
17 Hamilton-Harris Special	T. Gulotta	Off.	4	4.250	4.500	255	N	C	B	P	P.C.	W	2	R	C	C	B	Hart	Hart	M	Gil	1858	122.499	17	
21 P.O.B. Perfect Seal Sp.	L. Tomei	Miller	4	4.260	4.500	256	N	C	B	P	P.C.	M	2	R	C	C	B	H-G	H-G	H	Gulf	1852	121.594	21	
22 Thorne Engineering Sp.	J. Thorne	Off.	4	4.260	4.500	256	N	C	B	P	P.C.	W	2	F	R	C	C	G-F	G-F	H	Gulf	2115	119.155	22	
23 Burd Piston Ring Sp.	F. Roberts	Miller	4	4.328	4.875	270	N	C	B	P	Burd	W	2	R	C	C	B	H-H	H-H	H	Gulf	1912	125.506	23	
26 Sure Stop Brake Equal.	F. Brisko	Brisko	6	3.625	4.375	270	N	C	B	P	P.C.	W	3	F	R	C	C	Houd	Houd	M	Gulf	2022	121.921	26	
27 I. B. E. W. Special	Mauri Rose	Mas.	6	2.560	2.950	91	Y	R	S	For	P.C.	Web	1	R	C	C	H	Mas	Houd	H	B	Gulf	1370	119.796	27
29 Indiana Fur Co. Special	F. Wearne	Off.	4	4.328	4.875	270	N	C	B	P	P.C.	W	2	R	C	C	D	Houd	Houd	M	Gil	1938	121.425	29	
31 Shafer 8 Special	C. Crawford	Buick.	8	3.250	3.875	257	N	C	D	P	P.C.	W	4	R	C	C	D	Houd	Houd	M	Gil	2024	112.762	31	
32 Hubert-Duesenberg Sp.	F. Frame	Off.	8	.....	.....	.....	Y	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	32	
33 Kimmel Special	H. Banks	Voelker	12	2.750	3.750	267	N	C	B	P	P.C.	Z	4	R	C	C	B	Houd	Houd	H	R.C.	2077	116.279	33	
34 McCoy Auto Service Sp.	Babe Stapp	Miller	4	4.125	4.250	228	N	C	B	P	P.C.	W	2	R	C	C	B	Gab	Gab	M	Gil	1729	120.598	34	
35 Pettillo Special	Kelly Pettillo	Off.	4	4.312	4.625	270	N	C	B	P	P.C.	W	2	R	C	C	B	Houd	Houd	H	B	2030	119.827	35	
36 Troy-Tyrol Special	Al Putnam	Miller	4	4.125	4.250	228	N	C	B	P	P.C.	W	2	R	C	C	B	Lov	Lov	T-T	Veedol	1850	116.791	36	
37 Greenfield Superservice	Ira Hall	Stude	8	3.062	4.250	250.4	N	C	B	P	P.C.	W	4	R	C	C	D	Houd	Houd	H	Gulf	2029	118.255	37	
38 Burd Piston Ring Sp.	Chet Gardner	Off.	4	4.260	4.500	256	N	C	B	P	P.C.	W	4	R	C	C	D	H-F	Hart	M-H	H	2063	120.435	38	
42 Elgin Piston Pin Sp.	Emil Andres	Brisko	6	3.625	4.375	271	N	C	B	P	P.C.	W	3	R	C	C	D	Houd	Houd	M	Gulf	2047	117.126	42	
43 Kohlert Special	Duke Nation	Miller	8	2.656	3.500	155	N	C	B	P	P.C.	W	4	R	C	C	H	Hart	Hart	M	Gulf	1603	113.828	43	
44 Miller Special	Rick Decker	Miller	8	.....	168	Y	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	44	
45 Marchese Special	H. McQuinn	Miller	8	2.875	3.500	182	N	C	B	P	P.C.	W	4	R	C	C	B	Houd	Houd	H	Gulf	1806	119.492	45	
46 Ben Been Special	Doc Williams	Off.	4	4.062	4.750	247	N	C	B	P	P.C.	W	2	F	R	C	C	Hart	Hart	M	Gulf	1984	120.906	46	
47 Kamme Special	S. Cantion	Miller	4	3.875	3.875	183	Y	C	B	P	P.C.	W	2	R	C	C	D	Lov	Lov	H	Gulf	1965	120.906	47	
49 Kirkham-Maserati Sp.	Mas.	Off.	8	.....	181	Y	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	49	
51 Stewart Special	M-B.	Off.	4	4.312	4.250	248	N	C	B	P	P.C.	W	2	R	C	C	B	D	D	H	.....	2172	.....	51
52 Sampson-Litz Special	Decon Litz	Off.	4	4.250	4.625	262	N	C	B	P	P.C.	W	2	R	C	C	B	H-H	H-H	H	.....	1840	.....	52
53 Uhl Special	J. Sawyer	Dues.	8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	53	
54 Offenhauser Special	H. Ardinger	Off.	4	4.250	4.500	255	N	C	B	P	P.C.	W	2	F	C	C	B	Gab	Gab	M	Gulf	1968	119.022	54	
55 Domonts Pepsi-Cola Sp.	Al. Miller	Miller	4	4.250	4.500	255	N	C	B	P	P.C.	M	2	R	C	C	B	Houd	Houd	Fag	Gulf	2023	119.420	55	
56 Clemmons Special	J. Seymour	Clem.	4	3.500	3.625	139.5	Y	C	B	P	P.C.	W	2	F	Ind	C	.....	.....	.....	.....	.....	.....	56	
57 Miller-Duesenberg	J. Pettiford	Billy DeVore	8	.....	91	Y	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	57	
58 P. R. & W. Special	Off.	Billy DeVore	4	4.250	4.500	255	N	C	B	P	P.C.	W	2	R	C	C	D	H-H	H-H	H	Gil	1986	116.339	58	

B—Bowes

R—Bosch

P—Packard

For—Foreign make

Ignition

B—Bosch

BT—Bosch, twin ignition

D—Delco

S—Swiss Scintilla

Piston Rings

P.C.—Perfect Circle

Amer—American

Hammered

Carburetor

W—Winfoeld

M—Miller

Web—Weber

Z—Zenith

Drive

F—Front

R—Rear

Wheel Suspension

C—Conventional

Ind—Independent

Starter

B—Bosch

D—Delco

H—Hand crank

A—Air drill

C—Cartridge

F—Ford

Shock Absorbers

Gab—Gabriel

Hart—Hartford

H-H—Hartford-Houde

Houde—Houde

Loy—Lovejoy

G-F—Gabriel-Fageol

D—Delco

M—Miller

Mas—Maserati

Brakes

H—Hydraulic

M—Mechanical

M-H—Mechanical, front

Hydraulic, rear

H—Hydraulic, disk type

Fuel

Gil—Gilmore

B—Alcohol blend

T-T—Troy-Tyrol

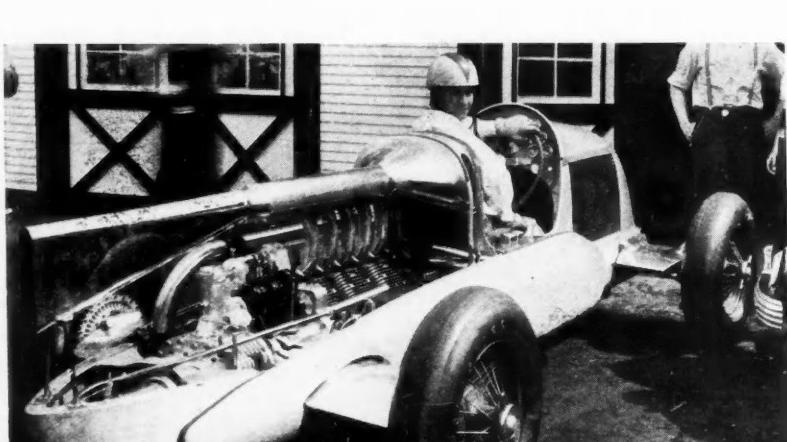
Cil—Gilmore

O—Oizum

B—Baker (eastor oil)

S—Stalube

This car of Harry Miller's was completed too late to qualify. It has four-wheel drive by means of two drive shafts. The engine is a six-cylinder, supercharged model. Note that the cylinders are tilted at an angle of 45 deg.



Offenhauser engine; fourth, No. 2. Miller engine; fifth, No. 38, Offenhauser engine; sixth, No. 54, Offenhauser engine; seventh, No. 45, Marchese engine; eighth, No. 58, Offenhauser engine; ninth, No. 22, Offenhauser engine; tenth, No. 29, Offenhauser engine.

That the first two cars finished with only one stop was no surprise to many of the fans who knew these cars had 30- and 25-gal. tanks—Shaw added a 10-gal. tank this year to replace his mechanic. Roberts made only a 1 min. 17 sec. stop on the 107th lap for gasoline and right rear tire. This was due to the greater mileage obtained on gasoline than on alcohol blends—Synder on No. 6, for instance, had a 50-gal. tank and had to refuel at 187 miles while Roberts, with 30 gal. of gasoline, refueled at 252 miles. Roberts was getting 8 to 9 miles per gal. on gasoline, Synder 3 to 4 miles on alcohol.

The alcohol fuel cars were, however, extremely interesting because of their many unusual features. Three were sixes, one an eight. Rex Mays' car was the 8-cylinder, 180 cu. in. Alfa-Romeo and Mauri Rose's Maserati was a six with only 91 cu. in. displacement, the smallest car in the race. Both used Root's type blowers.

The two Sparks cars No. 6 and 16 were sixes with centrifugal superchargers and had 179 cu. in. displacement. They carried the largest fuel tanks of 50-gal. capacity. Rex Mays' Alfa had 47-gal. capacity. The fuel used was approximately a blend of 80 per cent alcohol and 20 per cent benzol.

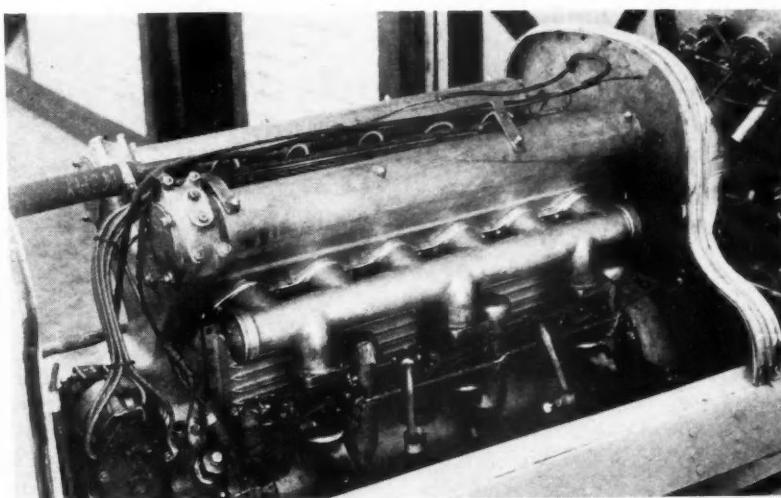
The design of the Sparks engines

was most unique in the placing of the supercharger at the rear end of the engine and driving it from the gear train at the front end by means of a long solid shaft. The supercharger outlet was connected to the intake manifold by a hose coupling. This was tested at 250 lb. pressure and thought adequate but was the cause of both Synder and Householder dropping out of the race—they both blew off these hose connections and were unable to continue.

The Alfa-Romeo had magnesium cylinder block with the valves seated directly on the cylinder head. Apparently they worked very well as the car ran perfectly until the supercharger froze and put the car out.

Changing many cars from two seaters to single seaters introduced very interesting problems—some drivers put metal cowls over the other seat or as Ira Hall did—just buttoned a cover made from top fabric. The true one man cars placed the driver in the center and he had to straddle the drive shaft and transmission unless the car had front wheel drive. This construction was like riding a horse—instead of a saddle the boys wrapped their gear boxes with sponge rubber to insulate it from their legs. Most transmissions also had breathers to let out the heated air.

*Oil coolers were found on most of
(Turn to page 766, please)*



This six-cylinder Brisko was a non-supercharged entry. Its qualifying time was nearly 122 m.p.h. but was forced out of the race in the 39th lap with a broken oil line

Final Time Trial Data

Date of Trials—May 21 to 28, 1938
Time—10 A.M. - 1 P.M. to 7 P.M.
Event—Trials

Distance—10 Laps - 25 Miles
Sanction—3600

Ranking Car No.	Car Name	Driver	Fastest Lap	Time	Average M.P.H.	Starting Position	Ranking Car No.	Car Name	Driver	Fastest Lap	Time	Average M.P.H.	Starting Position
1st 16	Thorne-Sparks Special	R. Householder	126.707	11:55.60	125.769	(10)	18th 15	Marks-Miller Special	George Connor	122.266	12:27.97	120.326	(19)
2nd 23	Burd Piston Ring Special	Floyd Roberts	126.886	11:56.10	125.681	(1)	19th 35	Pettillo Special	Kelly Pettillo	124.723	12:31.08	119.827	(21)
3rd 14	D-X Special	R. Snowberger	125.156	12:05.65	124.027	(2)	20th 27	I. B. E. W. Special	Mauri Rose	120.660	12:31.28	119.796	(9)
4th 6	Sparks-Thorne Special	Jimmy Snyder	125.348	12:08.71	123.506	(15)	21st 45	Marchese Special	Harry MacQuinn	121.359	12:33.19	119.492	(25)
5th 8	Alfa-Romeo	Rex Mays	124.775	12:12.63	122.845	(3)	22nd 55	Domont-Pepsi-Cola Sp.	Al Miller	120.000	12:33.64	119.420	(22)
6th 17	Hamilton-Harris Special	Tony Gulotta	123.203	12:14.70	122.499	(4)	23rd 22	Thorne Engineering Sp.	Joe Thorne	120.240	12:35.32	119.155	(13)
7th 7	I. B. E. W. Special	Bill Cummings	123.525	12:15.34	122.392	(16)	24th 54	Offenhauser Special	Herb Ardinger	120.724	12:36.16	119.022	(14)
8th 26	Shur-Stop Brake Eq. Sp.	Frank Brisko	123.069	12:16.18	121.921	(11)	25th 10	Belanger Special	Tony Willman	119.538	12:39.76	118.458	(26)
9th 3	I. B. E. W. Special	Chet Miller	123.321	12:18.32	121.894	(5)	26th 37	Greenfield Super-Serv. S.	Ira Hall	119.095	12:41.07	118.255	(27)
10th 21	P. O. B. Perfect Seal Sp.	Louis Tomei	122.233	12:20.17	121.594	(24)	27th 42	Eglin Piston Pin Sp.	Emil Andres	117.909	12:48.40	117.126	(28)
11th 29	Indiana Fur Special	Frank Wearne	123.666	12:21.32	121.405	(17)	28th 36	Troy Tydol Special	Al Putnam	117.371	12:50.61	116.791	(23)
12th 2	Miller-Hartz Special	Ted Horn	122.917	12:21.80	121.327	(7)	29th 12	Barbasol Special	Frank Beeder	117.724	12:53.24	116.393	(29)
13th 1	Shaw Special	Wilbur Shaw	122.001	12:23.88	120.987	(8)	30th 58	P. R. & W. Special	Billy DeVore	117.157	12:53.60	116.339	(30)
14th 47	Kamm's Special	"Shorty" Cantlon	122.100	12:24.38	120.906	(20)	31st 33	Kimmel Special	Henry Banks	118.312	12:54.00	116.279	(31)
15th 34	McCoy Auto Service Sp.	Babe Stapp	121.017	12:26.30	120.595	(6)	32nd 9	Kraft's Real Rye Special	Cliff Bergere	115.031	13:06.27	114.464	(32)
16th 5	Bowes Seal Fast Special	Louis Meyer	121.852	12:26.73	120.525	(12)	33rd 43	Kohler-Miller	Duke Nalon	114.884	13:10.67	113.826	(33)
17th 38	Burd Piston Ring Special	Chet Gardner	121.017	12:27.29	120.435	(18)	34th 31	Shafer "8" Special	Chas. Crawford	113.851	13:18.14	112.762	All

Motor Fuels Produced by

Hydrogenation

IN the production of synthetic motor fuels by hydrogenation processes, use is now being made of more active catalysts; these catalysts, moreover, are fixed in the processing apparatus, instead of being finely divided and mixed with the liquid mass to be hydrogenated, which rendered their recuperation difficult. Catalysts at present have a long life. The I. G. Farben Co. is said to have developed catalysts which are immune to poisons, particularly to sulfur. There are even some catalysts which are activated by sulfur. A general review of the present status of the production of motor fuel by hydrogenation was published by G. Fausser in *La Chimica e l'Industria*, from which the following is abstracted.

Hydrogenation gasoline is purer than gasoline produced from petroleum, and the gum content especially is much lower. Taking account of the coal necessary to manufacture the hydrogen and producing the heat and electrical energy, one ton of synthetic gasoline is obtained from 4 to 5 tons of coal, and the figure drops to below 4 tons if the butane and propane gases are recuperated.

By the hydrogenation of petroleum residues, utilizing the hydrogen of the permanent gases formed during the reactions, an efficiency in gasoline production of more than 80 per cent is obtained. The nitrogen, the oxygen, and the sulfur present in the raw materials are eliminated in the form of ammoniac, of water vapor, and of sulfuretted hydrogen. The process, therefore, is particularly applicable to poor grades of petroleum containing much sulfur. Asphalt-base oils, the tars of bituminous shales and other products of the cracking still are treated under a pressure of 600 atmospheres. Coal tar also forms an excellent raw material, and yields of 85 per cent are obtained.

Of even greater interest is the manufacture of aviation fuels and of high-grade lubricants by starting with poor grade oils. By replacing a 73-octane gasoline with one of 100 octane, the output of an engine is

increased 26 per cent, due to the higher compression permissible, and the fuel consumption at the same time is decreased 29 per cent. Aviation has need for fuels that are not only very pure, very stable, and of a gravity between certain limits, but the fuel also should remain homogeneous without congealing at low temperatures (-58 deg. Fahr.), and it must not be too volatile. At a temperature of 100 deg. Fahr. its vapor pressure must not exceed 7 lbs. per sq. in.

Aviation gasoline extracted from special crude oils, such as those of Borneo, has an octane number of 76, and good naphthenic crude oils give a gasoline of 71-72 octane. In both cases it takes too much tetra-ethyl lead to carry the octane number up to 85-90. The addition of benzol, which also increases the octane number, has the disadvantage that the blend will congeal at very low temperatures.

It is also possible to subject ordinary gasoline to a cracking and reforming process, but the losses due to gas formation are important, and the octane number drops materially if the engine is at a high temperature, which is due to the presence of non-saturated hydrocarbons. On the contrary, hydrogenation gives fuels of exceptional qualities. By operating at 930 deg Fahr., one obtains a gaso-

line which is free from sulfur and has a large aromatics content, which gives it an octane number of 80-90, but the yield is rather low. A yield of approximately 100 per cent by volume is obtained by operating at a moderate temperature, with the aid of a catalyst of a new type, of great conversion power, which induces a selective hydrogenation of cyclic molecules, in such a way as to produce a gasoline which is rich in naphthenes, and which thus has a high octane number, is very pure, free from gums, is very susceptible to tetra-ethyl lead additions, and has a low aromatics content. Thus the Standard Oil Co. of New Jersey at Bayway manufactures a gasoline of 76.8 octane, whose octane number is increased to 87, 92.9 and 97.5 by the addition of 0.83, 2.50 and 4.54 cu. cm. of tetra-ethyl lead per gallon, respectively.

The gases produced in the cracking process contain a large quantity of isobutylene, which may also be obtained by heating butane to 1300 deg. Fahr. It polymerizes cold by contact with sulfuric acid into di-isobutylene (with 20 per cent of other polymers, which are easily eliminated by fractional distillation). Hydrogenation of the di-isobutylene at 400-475 deg. Fahr. under 30 atmospheres pressure gives a yield of 99 per cent of iso-octane whose octane number is 100 by definition. Its specific gravity is 0.694. It boils at 210 deg. Fahr. and it therefore cannot be used in engines in the pure state, but is used blended with hydrogenation gasoline.

The use of Diesel engines in railcars and in aircraft will certainly increase when fuels of better quality

(Turn to page 763, please)

Hydrogenation Plants Now in Operation

Country	Location	Company	Raw Material Used	Capacity in 1000 tons per year
Germany	Leuna	I. G. Farben	Lignite and tar	350
Germany	Boehlem	Brabag I	Lignite and tar	175
Germany	Magdeburg	Brabag II	Lignite and tar	175
Germany	Scholven	Hidernia	Coal	125
England	Billingham	Imperial Ch. Ind.	Coal and tar	150
U.S.A.	Baton Rouge	Standard Oil	Mineral oil	250
U.S.A.	Bay Way	Standard Oil	Mineral oil	250
Italy	Bari	A.N.I.C.	Mineral oil	125 gas. 30 lub. oil
Italy	Livorno	A.N.I.C.	Mineral oil	125 gas. 30 lub. oil
				Total 1875

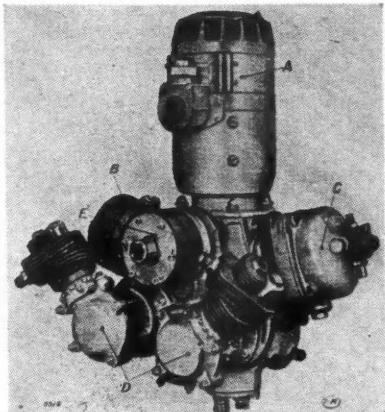
Accessories Drive Unit for Aircraft

A PROBLEM that is giving considerable trouble to the designers of aircraft engines is that of providing suitable mounting and driving facilities for the constantly increasing number of accessories called for by modern aircraft engineers. Originally the necessary accessories were mounted on the crankcase and driven through gearing directly from the crankshaft, but the present tendency is to group a number of them together and to mount them away from the engine, from which they are driven through a jointed shaft. Advantages of this arrangement are that it simplifies the engine, making it more accessible and easier to install in and remove from the plane, and that at the same time it protects the accessories from the heat and vibration of the engine.

In France there are at present two types of these accessories drive units

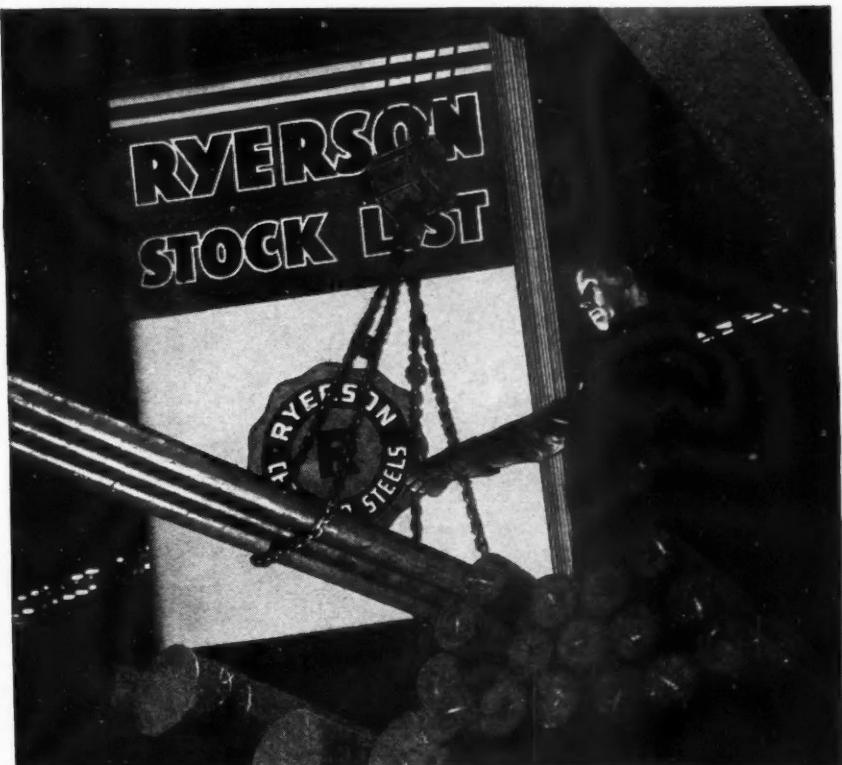
The drive for the accessories unit is generally taken from the crankshaft directly, which obviates difficulties due to the elastic mounting of the engine, as any movement of the engine relative to its mounting is most likely to be a slight rotation

around its axis. This arrangement, however, requires that a shaft be passed through the blower, which is generally arranged concentric with the crankshaft, and it also necessitates a new location of the inertia starter, which formerly was placed



Gnome-Rhone accessories-drive unit

(which the French call relays), that of the Air Equipment Co. and that of the Gnome & Rhone Co. Both of these were designed for use on the Gnome & Rhone 14- and 18-cylinder two-row radial engines. They are laid out to accommodate five and seven driven accessories, respectively, and they comprise several gear trains permitting of imparting different speeds to these accessories. The housings are cast of magnesium, and the weight is only about 22 lb., which is quite low considering that the power transmitted amounts to about 15 kw.



Your Guide to Certified, Uniform High Quality Steels . . .

The Ryerson Stock List is your guide to large and diversified stocks of steel—the only stocks of Certified Quality Steels in the country. You have definite assurance of getting steel which has the features most desirable in the particular kind you order—whether it is a deep drawing quality sheet, high tensile structurals, easy machining screw stock or high finish stainless.

On alloy steels you get still another added feature. Ryerson sends accurate data on every bar delivered so that your heat treater can easily secure desired results—a service never before attempted by any steel-service company.

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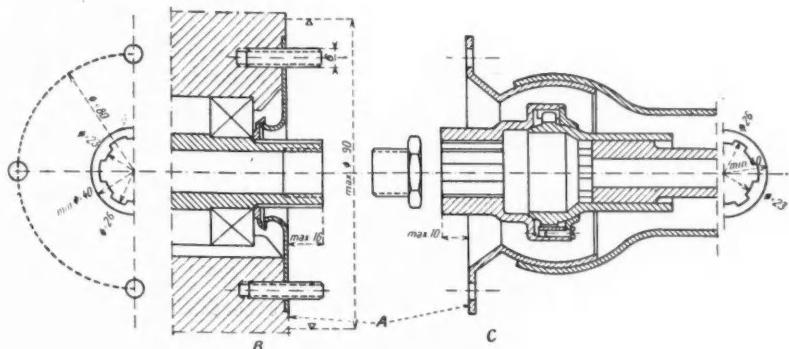
JOSEPH T. RYERSON & SON, INC. Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

RYERSON
Certified
STEELS



Proposed power take-off standard.

A, electric generator; B, air compressor; C, oil pump; D, air compressors; E, rubber type universal joint through which unit is driven.



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- Those firms that use stampings to the point that they are major items in cost, long ago learned the value of the Danly Precision Die Set.

They know that precision pays, in the freedom from shearing, less regrinding and, above all, insurance against die destruction and production line tie-ups.

Precision Pays—make sure you get it by specifying Danly Precision Sets for mounting all your dies.

DANLY MACHINE SPECIALTIES, Inc., 2118 So. 52nd Ave., Chicago, Ill.

DANLY

DIE MAKERS' SUPPLIES

concentric with the crankshaft.

A proposed standard for the power take off for accessories drives is now under consideration. As shown by the drawing herewith, it comprises a splined fitting with a diameter over the outside of the splines of approximately 1 in.

As there is considerable elasticity in the members of the airplane, it is necessary to use flexible couplings at both ends of the shaft connecting the accessories drive unit to the crankshaft. Gnome-Rhone uses metal-rubber joints, which have the advantage of completely absorbing vibrations, but they are rather bulky. — *La Technique Moderne*, April 15.

Fewer Models of German Cars

German automobile manufacturers, at the instigation of the Ministers of Commerce and Transport, have set up a program looking toward a reduction in the number of different models produced. It provides for a first reduction of 15 per cent, and for 1939 a reduction of 25 per cent in the number of models is contemplated. It is also stipulated that a firm must not introduce a new model on the market without at the same time discontinuing an old model. The object is to increase the scale of production and thus cut costs.

These Lucky U.S.A.

"The United States of America was blessed by Nature with a plentitude of all of the raw materials. It possesses a superabundance of coal, phosphates and sulfur, both within and immediately outside its borders; and in its zones of commercial and political influence there are copper and zinc ores, and petroleum. There is within the United States sufficient bauxite (aluminum) to meet the needs of the country; sufficient iron ore, lead ore, gypsum and talc, while asbestos is found in its colonies. The

U. S. is dependent on imports from other countries only for a small number of raw materials, such as chromite, nickel, tin ore and nitrates (from Chile). There is no second country in the world in which industry can develop on the basis of such a plentiful supply of domestic raw materials as in the United States." —Summary of an article on "Stocks of Raw Materials in the United States," by Rudolf Seiden in *Chimie et Industrie* for April.

European and American Light Cars—a Contrast

BRITISH motoring papers regularly conduct road tests on new cars and publish the results in their columns. By a coincidence, reports of test of the small Fiat car, the Fiat 500, and one of America's low-priced cars, the Chevrolet, appeared in the same issue of *The Autocar* and permit of an interesting comparison. The Chevrolet evolved from a small car, and people are still inclined to consider it such, but a comparison with the Fiat shows that it differs widely from the European conception of a small car. The prices in England, moreover, are widely different; figuring the pound sterling as equal to \$5, the Fiat sells as \$634, while the Chevrolet Master Deluxe sedan sells at \$1,650. There is an even greater relative difference between the annual taxes on the two cars, that of the Fiat being \$26.25 and that on the Chevrolet, \$112.50. Following are some of the specifications and test data of the two cars as printed in *The Autocar*:

	Fiat 500	Chevrolet Master
Piston displacement	35 cu. in.	216 cu. in.
Aver. tread	43 in.	58 in.
Wheelbase	78½ in.	112½ in.
Weight without passengers	1183 lb.	3118 lb.
Mean max. timed speed	51.58 m.p.h.	80.00 m.p.h.
Acceleration in high gear		
10-30 m.p.h.	30.6 sec.	7.7 sec.
20-40 m.p.h.	37.3 sec.	8.1 sec.
30-50 m.p.h.	.....	9.2 sec.
Acceleration in next-to-highest gear		
10-30 m.p.h.	13.9 sec.	5.0 sec.
20-40 m.p.h.	23.2 sec.	5.4 sec.
30-50 m.p.h.	.....	7.9 sec.

The Fiat 500 is one of the smallest cars in quantity production in Europe, and the foregoing figures bring out clearly the difference between the performance of European "baby" cars and the performance American motorists are accustomed to.

Hydrogenation

(Continued from page 760)

are produced. The moderate-density liquid fuel produced by hydrogenation from a bituminous coal has a cetane number of only 10-20. By hydrogenation in the vapor phase, it can be transformed into a Diesel fuel of 55-60 cetane number, which is suitable for high-speed Diesel engines.

By hydrogenation it is possible also to improve lubricating oils by

starting from asphaltic crudes or from the tars of bituminous shales and asphaltic rocks. They then show better resistance to oxidation, the flash point is raised, the Conradson carbon content is lowered (less carbon deposits), and the viscosity index is lowered, which is to say, the viscosity changes less rapidly with temperature, the same as it does in Pennsylvania oils, the viscosity being

TOPS in MTC

MOTOR TEMPERATURE CONTROL

- The automotive cooling system dissipates heat at a rate largely influenced by the speed of the car—but car speed has no relation to wind and cold weather.

The motor temperature control established by Dole Thermostats enters the picture to maintain a zone of maximum operating efficiency—a performance feature for the car manufacturer's reputation—an economy feature to pass on to the motorist.

Under the Dole engineering staff the production of automotive thermostats and THERMOSTATIC BI-METAL (for many purposes) has reached the proportions of leadership.

Consult with us about your particular requirements.

DOLE
Thermostats

THE DOLE VALVE COMPANY, 1901-41 Carroll Ave., Chicago, Ill.
DETROIT OFFICE: General Motors Building

due chiefly to paraffinic constituents of the long-chain type. The non-saturated contents and those of the short-chain variety are transformed by selective hydrogenation at 750 deg. Fahr. and at very high pressures, producing only a very limited cracking. By later fractionating the products obtained, which have a very high hydrogen content, a series of lubricating oils is obtained which meet all requirements.

This work is carried on under the patents of the International Hydrogenation Patents Co. of the Hague,

which was formed by the Standard Oil Co. of New Jersey, the Royal Dutch Shell, and the Imperial Chemical Industries of the I. G. Farben Co. and the Azienda Nationale Idrogenazione Combustibili. The plants actually in operation are shown in accompanying table.

In addition, four plants for the production of iso-octane are under construction, two in the United States (Standard Oil of California and Gulf Oil Co.), one in Persia (Anglo-Iranian Oil Co.), and one in the Netherlands (Royal Dutch). To-

gether they will have a capacity of 150,000 tons per year. In Germany there have been formed two new companies, the Gelsenberg Benzin A.G. and the Union Vereinigter Braunkohlen Kraftstoff A.G., for the manufacture of gasoline and of Diesel fuel from lignite and tar, which will raise the world capacity to three million tons per year. The two Italian factories work with Albanian petroleum.

Drip Collector for Marine Use

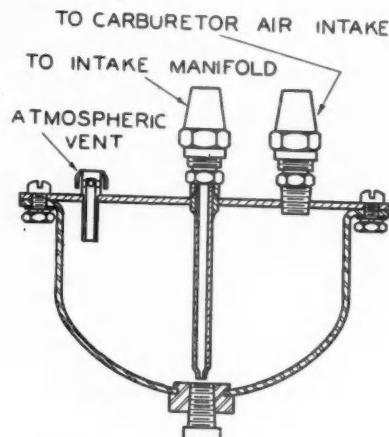
Zenith Carburetor Co., Detroit, has placed on the market its Zenith safety drip collector for marine carburetors. It differs from other drip collectors in that it is a closed vessel—except for the necessary vent—and that it protects the gasoline which collects in it from dirt and water. This drip collector serves as a reservoir for the fuel that condenses in the manifold and drains back to the carburetor when the engine is shut down. In addition, it acts as a primer for starting, by discharging a highly atomized mixture of gasoline and



ONLY LAPPING As Strom Does It CAN PRODUCE SUCH PRECISION

Strom Steel Balls possess a degree of surface smoothness and sphericity that has never been equalled in any other regular grade of ball. Such precision is exclusive with Strom because it can be attained only through a series of lapping operations such as are standard practice in the Strom plant.

Physical soundness, correct hardness, size accuracy and sphericity are guaranteed in all Strom Balls. Other types of balls—*stainless steel, monel, brass and bronze*—are also available in all standard sizes. Write for complete details.



Section of Zenith safety drip collector for marine engines

air directly into the intake manifold. The reservoir has ample capacity to hold all the fuel that drains back to the carburetor when the engine is shut down. The principal advantage of the new device is no doubt the added safety it ensures, as compared with the old-fashioned drip pan. The sectional view reproduced herewith shows the construction of the device clearly.

Perfect Circle Declares Dividend

The regular quarterly cash dividend of 50 cents per share on 162,500 shares of common stock outstanding has been declared by the Perfect Circle Co. The dividend is payable July 1, to stockholders as of record June 17, 1938.

Strom STEEL BALL CO.

1850 So. 54th Avenue, Cicero, Ill.

The largest independent and exclusive Metal Ball Manufacturer

Production Lines

Removes Scale

Many years ago, as time is measured in this fast moving industry, we witnessed the early experiments with the Bullard-Dunn process for removing scale from heat treated gears and other parts, by automatic and economical electro-chemical means. The process bid fair to remove the troublesome effects of scale in a simple way that assured a chemically clean metal surface. Just recently we have noted the application of the modernized process in large volume gear production.

Cutting Tax

Apropos the comment we made some time ago regarding the 4 per cent tax on lubricants, we learn that a prominent investigator is preparing a formal paper on the subject proving that the emulsion used in metal removal operations functions as a coolant rather than a lubricant. We shall welcome any scientific evidence along this line and believe that the Dept. of Internal Revenue would consider such evidence in its studies of taxable materials.

Changes Engines

Understand that a prominent truck manufacturer is planning an extensive program of entirely new engines. A group of these engines should be in production within 90 days or so for next year's models.

Die Castings on Tractors

One of the important farm tractor producers has adopted the use of several zinc die cast parts. One of these is a rocker arm support bracket, the other is a combination support for an ingenious oil filter.

With Propane

Industrial uses of propane have been spreading in a manner well worth noting. One large tractor

builder recently modernized and expanded heat treating facilities, adding an entire new section of carburizing

ing furnaces and drawing furnaces fired with propane. The same manufacturer, and others for that matter, use propane as fuel for engines on the factory block test.

Pressed Arms

One of the prominent tractor builders has developed a rocker arm design in which the part is made of two light steel stampings welded together. This design is used right through the line down to the smallest four-cylinder engine.—J. G.

**Starting FROM
TILL Quitting**

DERMA-SAN GUARDS INDUSTRIES' HANDS

SAVES COMPENSATION PAYMENTS BY PREVENTING OIL DERMATITIS

When you pour one pint of Derma-San into 35 gallons of cutting lubricant, you protect workers continuously against oil dermatitis. For Derma-San kills pus-forming germs before they attack your men. It helps keep plant efficiency at par . . . saves doctors' bills and compensation payments. No plant using cutting oils can afford to be without Derma-San—the most economical insurance against oil dermatitis that you can buy. Order a drum—today.

The HUNTINGTON LABORATORIES Inc.

DENVER

HUNTINGTON, INDIANA

TORONTO

DERMA-SAN
DISINFECTANT

Indianapolis Race

(Continued from page 759)

the cars. Some used cooling fins on the crankcase—others using dry sump engines provided cooling by a small radiator in front or by placing the oil tank in front of the radiator between the frame ends. The Harry Miller jobs which failed to qualify had a very unique cooling system both for the oil and water. The oil was cooled by a vertical tubing radiator just behind the grille.

The water was cooled by air entering the grille and forced out through the sides of the hood which were made in the form of a radiator on the rear engine driven car. On the other four cylinder models the radiators were in two banks on each side of the hood and the air circulated over and directed through them due to the shape of the hood. The Marchese No. 45 had an entirely different cooling sys-

tem from anything that has been seen at the Speedway. Four small radiators about 12 in. square and 6 in. deep were mounted in pairs on each side of the chassis. They were spaced about 15 in. apart. A sheet metal housing entirely enclosed them and a grille protected them at the front and rear ends. A louvre on top introduced air between the two radiators and one below drew it out. Two things were accomplished by this departure from current practice—the front end could be perfectly streamlined—the width of the one-man body was increased at the driver's position to meet the minimum requirements under the new international rules.

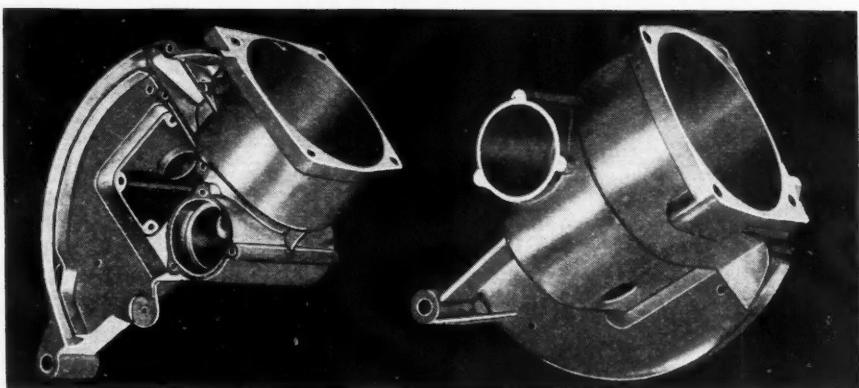
All the one-man cars had this method of increasing the width to meet the rules.

Some cars had very neat streamlined bulges on each side. In most cases they were useless appendages but not in the case of the Marchese job or the new Millers where these additions outside the frame formed the gasoline tanks. These were made from aluminum and hung on the side of the frame—extending the full distance between the axles. This construction had one important advantage—keeping the distribution of weight uniform as the fuel was used up. Cars carrying 50 gal. in the rear over the axle were constantly changing balance as they used up the fuel.

The frame construction on No. 45 was another unique feature. It was made from seamless steel tubes. The tubes, about 2 in. in diameter, were spaced about a foot apart vertically and formed the side rails, so as to say, of the frame. At the front and rear they came together at the tubular cross member. The front and rear axles were located between the upper and lower tubes. At the front the axle was carried by dual semi-elliptic springs—the upper one being attached to the upper tube—the lower one to the lower tube. They were shackled at the rear. Four springs carried the front axle. At the rear one, a transverse spring was used and attached behind the rear axle just as on a Ford V-8. Extensions of the radius were carrying the spring shackles. Speaking of springs—the Sparks jobs had the transverse front springs arranged very much like a Ford except that the radius rods were separate.

The familiar Miller construction with short transverse cross springs was found on both the new cars and the Offenhauser Special No. 54 driven by Ardinger. This construction is that of two rectangular leaves pivoted to the frame and steering knuckle. The axes of the pivots are

ALUMINUM AND ZINC BASE DIE CASTINGS



THE aluminum casting shown above is another example of Paragon quality.

We specialize in aluminum die castings as well as zinc, and are called upon by leading manufacturers when intricate castings are required.

The next time you are in the market for aluminum or zinc base die castings why not send us your inquiry for our attractive quotation.

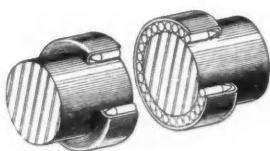
**PARAGON DIE CASTING CO.
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TORRINGTON NEEDLE BEARING DESIGN AND SERVICE FEATURES



BEARING HOLDS AMPLE LUBRICATION FOR LONG PERIODS

Reduces Need of Service Attention

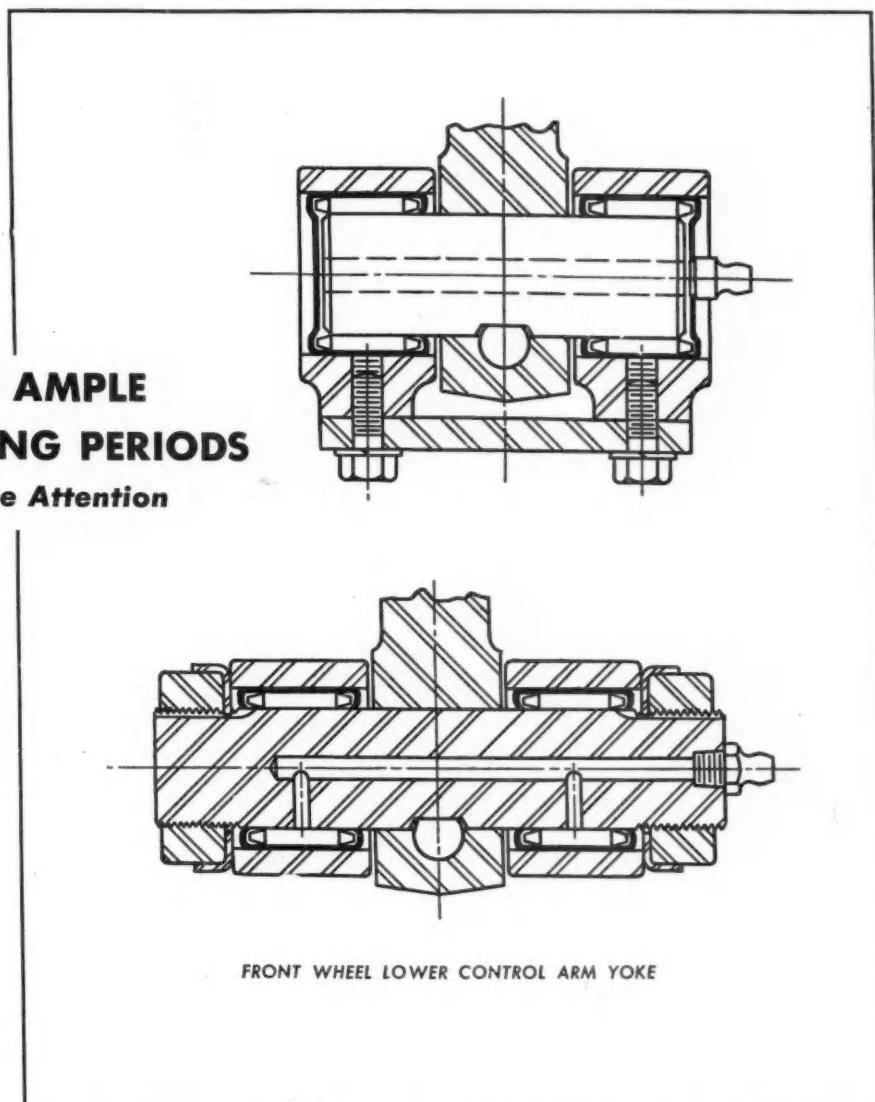
EASE OF LUBRICATION of the new Torrington Needle Bearing contributes materially to the assurance of long periods of trouble-free operation in severe applications such as the one illustrated.

Because the turned-in lips of the retaining shell hold an ample supply of oil or grease, the need of service attention is reduced to a minimum—a marked advantage in the lower control arm yoke of a front wheel assembly.

Freedom from Wear

The high radial load capacity of the Needl-Bearing is an aid in reducing wear in heavy-duty applications. Its close tolerances and its ability to retain its original dimensions under severe conditions combine to eliminate "shake" from the front wheel assembly.

The bearing's high capacity—the result of a full complement of small-diameter rollers— aids also in the reduction of size and weight, both in the bearing itself and in the housing. Simplification of the housing design and ease of assembly of the bearing, because of its unit construction, permit the use of production-line methods. Low cost of the bearing also offers further economies, while retaining the advantages of complete anti-friction construction.



FRONT WHEEL LOWER CONTROL ARM YOKE

The Torrington Engineering Department places its long experience in the laying out of bearing applications at the service of manufacturers interested in investigating the use of this new type anti-friction bearing in their products. Further information is given in the Tor-

rington Needle Bearing Catalog, available on request. Write for Catalog No. 7.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.
Makers of Ball and Needle Bearings
Branch Offices in all Principal Cities

**TORRINGTON
NEEDLE BEARING**

all parallel to the frame so that the wheels have a vertical movement. The leaves are streamlined to enclose the springs and steering arms and make a very neat structure. An almost identical construction is used by Maserati and Alfa-Romeo except that torsion bars attached to the top load are used instead of $\frac{1}{4}$ elliptic springs found on the Millers.

The car which Joe Thorne toolled into ninth place was equipped with a radio sending and receiving set—station W9XSA. He felt it would be invaluable during the race.

Tires of large section were used by most of the cars. Rose had the smallest. Six inches was the smallest section tire found on any of the first 10 finishers but these were on 20-in. wheels. Five were on 18-in. wheels and the rest on 16. In section, 6 to $7\frac{1}{2}$ in. were used. The 16 in. wheels were on the drop center type because they were so much lighter. As much as 14 lb. per wheel was saved by using 16 instead of 20 in. wheels. As much as 10 lb. saving in weight per wheel was obtained by the use of duraluminum rims on flat base 20 in.

wheels. The greater saving in weight with the small 16 in. wheels was the reason for their adoption. One driver claimed this difference in weight kept the inertia down and increased the car speed 1 to 2 sec. per lap. At the speed they were lapping the $2\frac{1}{2}$ mile oval this meant $2\frac{1}{2}$ to $3\frac{1}{2}$ miles an hour greater speed.

During the race getting gasoline into tanks was an important thing. Rex Mays' pit had compressed air on the 50-gal. barrel of fuel and filled his tank with 50 gal. in less than 15 sec.



For A Perfect Vacation

Enjoy Chicago's unequalled program of Summer Sports and Recreation, while living in the refined atmosphere of one of the world's finest hotels. Overlooking Beautiful Lake Michigan.

A. S. KIRKEBY, *Managing Director*

The Drake

LAKE SHORE DRIVE • CHICAGO

Eaton Axle Has Unit Production Lines

(Continued from page 754)

made rear axles for trucks.

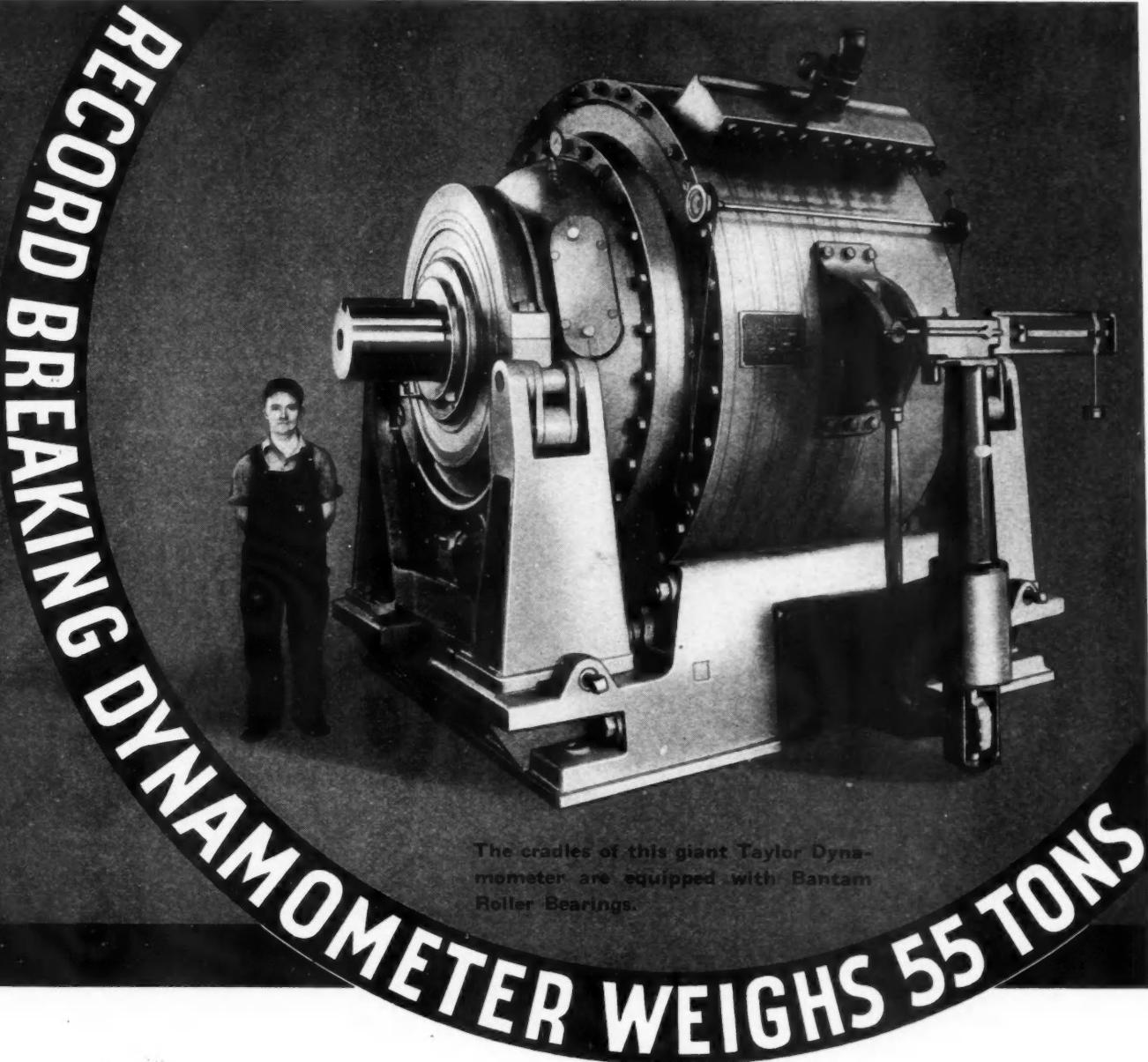
In 1915 operations were removed to Cleveland, Ohio, and the company incorporated under the name of Tornbensen Axle Co., manufacturing front and rear axles for trucks. Not until 1923, with the acquisition of the Perfection Spring Co., was the name changed to the Eaton Axle & Spring Co. From that time to the present, nine other companies have been absorbed into the parent organization now called the Eaton Mfg. Co.

With the addition of its subsidiaries, Eaton's list of products has greatly expanded until it now includes: front and rear axles for commercial vehicles, chassis leaf springs, bumpers, coil springs (including valve springs and wire products); stampings, heaters, valves, valve lifters, valve seat rings, and spring washers.

The production organization of the Eaton Axle Division is headed by C. I. Ochs, president and general manager, and also includes J. H. Waring, factory manager, Neil McLeod, factory superintendent, and C. H. Hunt, production manager.

Making Wool Non-Shrinkable

The British Research Association of the Wool Industry, in collaboration with the Research Association of the Rubber Industry, has developed a process by means of which the shrinkage of wool is said to be reduced to a minimum. The rubber of latex is deposited on the surface of wool fibers in the same manner as coloring matter in dyeing. Threads so treated are said to have extraordinary resistance to tension and to friction and wear. The process has been patented and is to be exploited industrially.



The cradles of this giant Taylor Dynamometer are equipped with Bantam Roller Bearings.

THIS huge dynamometer is one of two produced by Taylor Manufacturing Corporation, Milwaukee, Wisconsin, and believed to be the largest ever built in the United States. These units are capable of absorbing 10,000 h.p. at 375 RPM and each weighs 55 tons.

To assure perfect performance, the cradles of these units are equipped with Bantam Roller Bearings.

More and more machine manufacturers are relying on Bantam for all bearing requirements. They know that Bantam makes a wide range of anti-friction bearings which enables selection of the one best suited to solve their individual problems.

BANTAM BEARINGS CORPORATION
SOUTH BEND, INDIANA
Subsidiary of
THE TORRINGTON CO., Torrington, Conn.



TAPERED ROLLER . . . STRAIGHT ROLLER . . . BALL BEARINGS

Ingenious Methods at Monmouth Products

(Continued from page 749)

for some time before they developed a die which would operate to their satisfaction as they found it difficult to obtain a suitable steel. A non-shrink alloy steel trade-named Keto was finally selected, the die itself being broached to the serrated form and then hardened. Careful attention to the manufacture of the die so that it would be dimensionally accurate when finished was essential

because of the importance of having the serrations parallel with the center line of the shaft.

After the serrations are sheared off, one end of the lever is threaded. The piece is then set up on a No. 6 Whitney hand miller and a locking flat is milled on the serrated end.

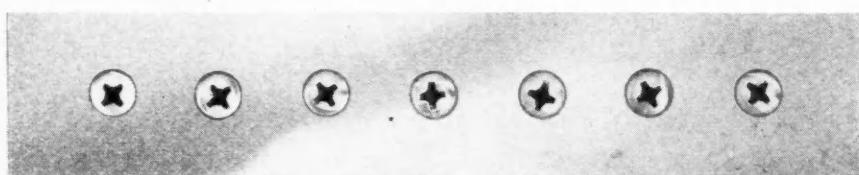
A $\frac{1}{8}$ in. by $\frac{5}{8}$ in. Woodruff key is milled at the opposite end of the shaft on the same machine. The

illustration on page 748 shows how the shaft is supported for milling. At the serrated end it is held firmly by spring pressure against the milled flat. Close tolerance is observed in this operation, the serrations and milled flat being held within one-half minute with respect to the center line of the keyway.

The shaft is then ground at each end to bearing diameter on a No. 2 Cincinnati centerless grinder. Lastly, two lips which later serve to back up a grease retaining washer are upset on the shaft. Upsetting of the lips is done with a small die on a No. 1 Toledo punch press.

Monmouth makes many different kinds of hardened and ground automotive parts for replacement and original equipment, such as shackle bolts, water pump shafts, gear shift levers, ball studs, rocker arm shafts for Diesel engines, differential pins and spiders, tappets, couplings for Diesel engine injection pumps, valve push rods for Diesel engines, king pins, and piston pins and other special screw machine products.

When the corporation was organized in 1920 it undertook the manufacture of piston pins only. About 10 years ago a number of products were added to the line and Monmouth also entered the replacement field at that time. Production personnel now comprises E. L. Davis, president and general manager; G. M. Salzman, plant superintendent; M. C. Ray, production engineer; and William Groth, assistant superintendent. The plant is equipped with four-spindle automatic machines, both vertical and carriage type; punch presses; hand screw machines; drilling and milling equipment; broaching machines; center and centerless grinding machines; and a complete heat treating department.



National PHILLIPS SCREWS Save Production Costs

Consider the following seven advantages of the Phillips Recessed Head and then let us send you samples and quotations:

1. Self centering on the driver
2. Holds driver from slipping
3. Drives faster
4. Eliminates head breakage
5. Prevents marring work
6. Makes better appearance
7. Simplifies hard-to-get-at jobs

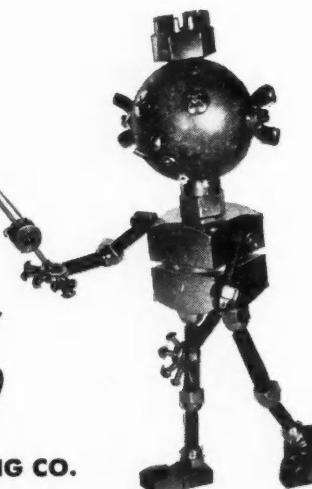
Sub-license for Phillips Screws granted by American Screw Co. Patent Nos. 2,046,837; 2,046,839; 2,046,343; 2,082,085; 2,084,078; 2,084,079; 2,090,338.

NAT SAYS . . .

I'll fish for lower costs
for you,
And catch them with the
Phillips Screw.

National
HEADED AND THREADED
PRODUCTS

**THE NATIONAL SCREW & MANUFACTURING CO.
CLEVELAND, OHIO**



Two Cylinders—24 hp.

There has been repeated mention recently of the use of leaf springs and hairpin-type springs for valves. Such springs evidently are particularly suited for use on valve-in-head engines, where they reduce the overall height (or width in the case of a horizontal engine). A new two-cylinder opposed motor-cycle engine developed by the Bayerische Motoren Werke has hairpin valve springs. This engine has two cylinders of $2\frac{11}{16}$ in. bore and stroke, and is said to develop 24 hp. at 5500 r.p.m. The displacement is 30.5 cu. in. and the specific output, therefore, 0.787 hp. per cu. in. The cylinder heads, in which the valves are located, are cast of aluminum alloy.

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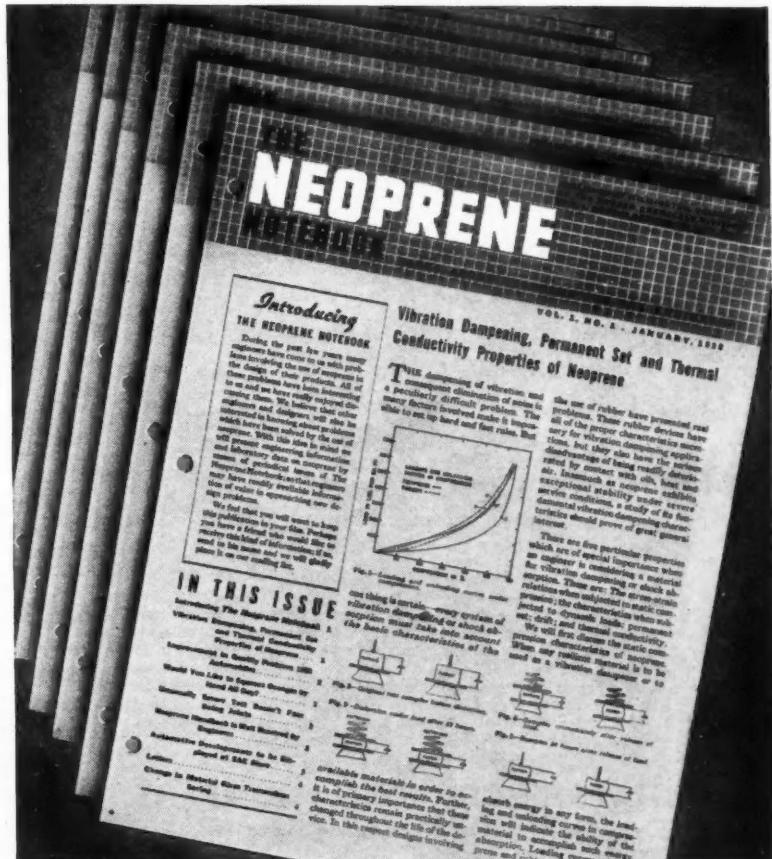


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